

Sir Thomas Gresham and Gresham College

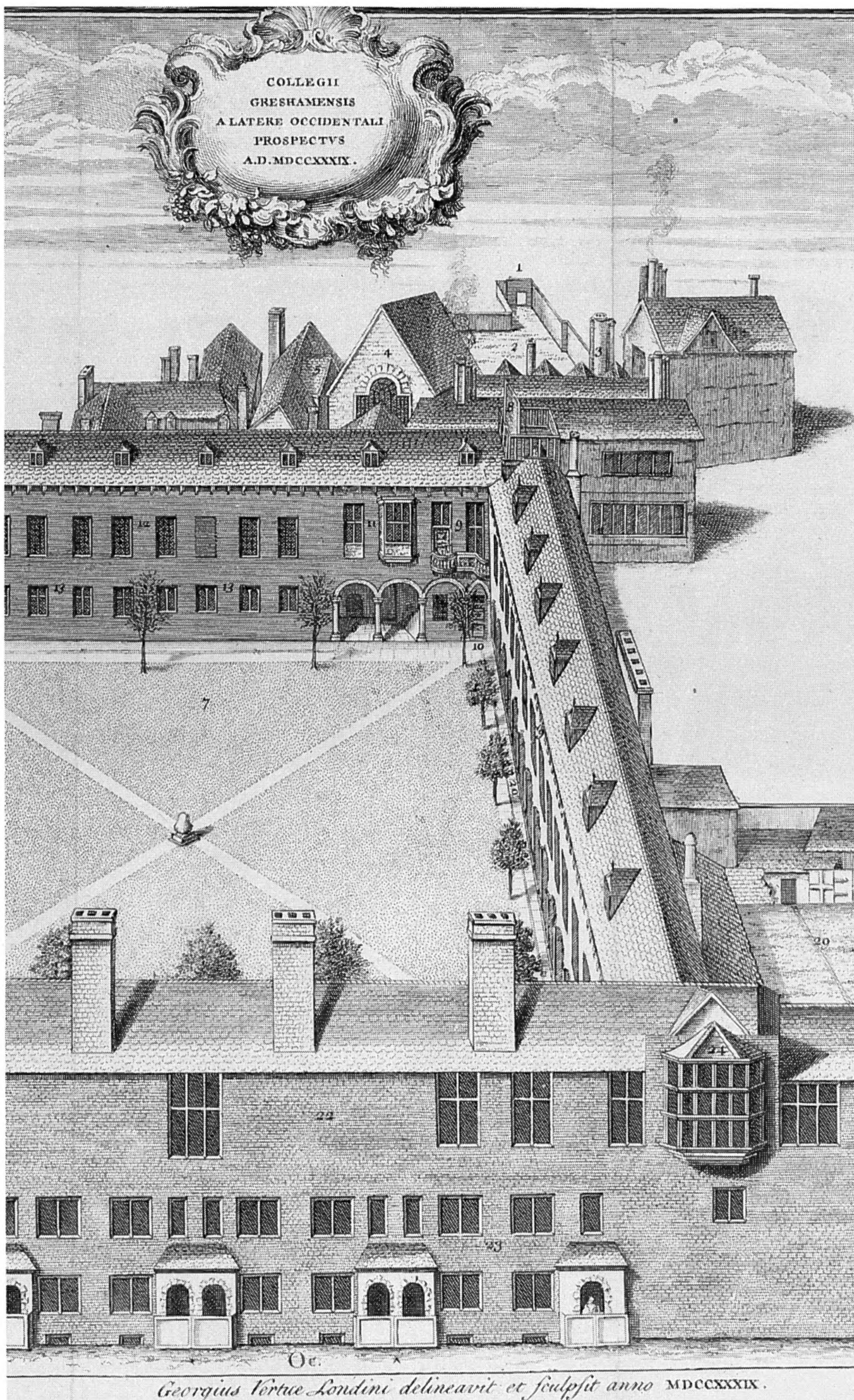
Studies in the intellectual history of London
in the sixteenth and seventeenth centuries

Edited by
Francis Ames-Lewis



ROUTLEDGE


**SIR THOMAS GRESHAM AND
GRESHAM COLLEGE**



George Vertue, Gresham College on Bishopsgate detail.
 (Detail of engraving for J. Ward, *Lives of the Professors of Gresham College*,
 London, 1740). Guildhall Library, Corporation of London.

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Contents

List of illustrations	vii
Notes on contributors	ix
Foreword <i>Francis Baden-Powell</i>	xii
Introduction <i>Francis Ames-Lewis</i>	xiii
1. Reconstructing London: Sir Thomas Gresham and Bishopsgate <i>Ann Saunders</i>	1
2. Sir Thomas and the 'House of Gresham': activities of a mercer- merchant adventurer <i>Ian Blanchard</i>	13
3. Citizen and mercer: Sir Thomas Gresham and the social and political world of the city of London <i>Vanessa Harding</i>	24
4. Failed transmission: Sir Thomas Gresham, reproduction, and the background to Gresham's professorship of physic <i>Margaret Pelling</i>	38
5. Early insurance in and around the Royal Exchange <i>Trevor Sibbett</i>	62
6. Sculpture at the Royal Exchange in the seventeenth century <i>Katharine Gibson</i>	77

7.	Civic rhetoric, 1560–1640 <i>Lynette Hunter</i>	88
8.	Plato in the Tudor academies <i>Sarah Hutton</i>	106
9.	<i>Testimonia humanitatis</i> : the early lectures of Henry Savile <i>Robert Goulding</i>	125
10.	‘No small force’: natural philosophy and mathematics in Thomas Gresham’s London <i>Stephen Clucas</i>	146
11.	Gresham College and London practitioners: the nature of the English mathematical community <i>Mordechai Feingold</i>	174
12.	Christopher Wren’s Greshamite history of astronomy and geometry <i>Jim Bennett</i>	189
13.	Why translate Serlio? <i>J.V. Field</i>	198
	Index	223

List of illustrations

LIST OF PLATES

1. George Vertue, *Gresham College on Bishopsgate*
- 2a & b. *Queen of Clubs and Four of Diamonds*
- 3a & b. *Six of Spades and Six of Diamonds*
4. *Seven of Clubs*
- 5a. Frans Hogenberg, *The exterior of the first Royal Exchange*
- 5b. Frans Hogenberg, *The interior of the first Royal Exchange*
6. George Vertue, *The first statue of Thomas Gresham*
7. Nicholas Stone, *Statue of Queen Elizabeth*
8. Unknown sculptor, *Statue of Charles I*
9. Wenceslas Hollar, *The Byrsa Londinensis*
10. Robert White, *The Cornhill façade of the second Royal Exchange*
11. John Bushnell, *Statue of Charles I*
12. John Bushnell, *Statue of Charles II*
13. Grinling Gibbons, *Statue of Charles II*
14. Sutton Nicholls, *The courtyard of the Royal Exchange*
- 15a. Attributed to Arnold Quellin, *Model for the statue of Henry VIII*
- 15b. Attributed to Arnold Quellin, *Model for the statue of Charles II*
- 16a. Attributed to Caius Gabriel Cibber, *Model for the statue of Edward III*
- 16b. Attributed to Caius Gabriel Cibber, *Model for the statue of Edward IV*

LIST OF FIGURES

1. John Roque, *Plan of the cities of London and Westminster*
- 2a. John Dee's 'hieroglyphic monad'
- 2b. Its geometrical construction
3. Diagrammatic representation of uniform difform motion of a body with initial velocity AB

4. Diagrammatic representation of a uniform difform motion of a body encountering uniform air resistance AFG
5. Diagram illustrating difference in the 'degree of motion' of a body
6. Muhammad al-Baghdadi's method for the proportional division of a quadrangle
7. Gateway in Tuscan or Rustic style
8. Church using the Corinthian order
9. Diagram for dividing an area ABC into two equal parts
10. Diagram for drawing the profile of an ornamental urn
11. Two perspective constructions for finding the images of squares

Notes on contributors

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Stephen Clucas is Lecturer in English and Humanities at Birkbeck College, University of London. He is editor of a forthcoming volume of essays on the Elizabethan mathematician and natural philosopher John Dee, *John Dee: interdisciplinary essays in English Renaissance thought* (Dordrecht, 1999), and is currently working on a book on Henry Percy, Ninth Earl of Northumberland (1564–1632) and his intellectual circle.

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Robert Goulding is Elizabeth Wordsworth Junior Research Fellow at St Hugh's College, Oxford. He is currently completing a doctorate at the Warburg Institute, University of London, on the mathematical papers of Sir Henry Savile. His previous publications concern proto-Tychonic planetary theory among Savile's European collaborators and the parallaxic theory of John Dee and Thomas Digges. At present he is researching the circulation of Regiomontanus' manuscripts in sixteenth-century Nuremberg, and the pre-history of logarithms.

Katharine Gibson has published articles on the coins and medals of King Charles II of England, and on the 1682-84 decoration of St George's Hall, Windsor, as well as on the statuary at the Royal Exchange. The iconography of Charles II was the subject of her recent PhD thesis at the Courtauld Institute of Art, and she hopes to publish more on this topic and on the King's patronage.

Vanessa Harding is Senior Lecturer in the History of London at Birkbeck College, University of London. Her research focuses on the society, economy and culture of late-medieval and early-modern London. She has published on London's archives and on the capital's demography, growth, and physical development. She is currently finishing a comparative study of death and burial in early modern London and Paris.

Lynette Hunter is Professor of the History of Rhetoric at the University of Leeds and Gresham Professor of Rhetoric (1997-2000). She has written on political rhetoric throughout the post-medieval period, and has a substantial interest in domestic and household literature in the Renaissance. With Peter Lichtenfels, she is currently co-editing *Romeo and Juliet* for the Arden Shakespeare.

Sarah Hutton is Reader in Renaissance and Seventeenth-Century Studies at the University of Hertfordshire. Her publications include *New perspectives on Renaissance thought* (edited with John Henry, London, 1990), *Henry More (1614-1687). Tercentenary studies* (Dordrecht, 1992), and a revised

edition of Marjorie Nicolson's *Conway Letters* (Oxford, 1992). Her edition of Cudworth's *Treatise Concerning Eternal and Immutable Morality* was published by Cambridge University Press in 1996. Most recently she has edited, with Lynette Hunter, *Women, science and medicine, 1500-1700* (Alan Sutton, 1997). She is currently working on a book-length study of Anne Conway.

Margaret Pelling is a University Research Lecturer in the Modern History Faculty, University of Oxford. Her research interests focus on health, medicine and social conditions at and below the level of the 'middling sort' in early modern English towns. Recent publications include *The common lot: sickness, medical occupations and the urban poor in early modern England* (London, 1998). She is currently completing a monograph on unlicensed practitioners in London, 1550-1640.

Ann Saunders read History at University College London, and later wrote a PhD thesis on Regent's Park, at the University of Leicester. She has written extensively on the capital city, her main books being *Art and architecture of London* (Phaidon, 1984, 1988, 1992 and 1996) and *The Royal Exchange* (London Topographical Society, 1997), a collection of thirty essays by various contributors which she edited and partly wrote.

Trevor Sibbett has written extensively in the actuarial and insurance fields mainly for actuarial publications. Together with Steven Haberman, he edited the *History of actuarial science*, 10 volumes (London, 1995). Most recently he edited the catalogue for the exhibition to commemorate 150 years of the Institute of Actuaries on 8 July 1998, and he wrote the article on the exhibition in the July 1998 issue of *The Actuary*.

Foreword

Francis Baden-Powell

Gresham College was delighted to be approached by the Society for Renaissance Studies with the suggestion that, in the College's quatercentenary year, we might collaborate on a conference on Sir Thomas Gresham and Gresham College.

It gave me very great personal pleasure to open the proceedings of the conference in March 1997 and I was fascinated by the wealth of scholarship exhibited. Sir Thomas would have been delighted with the variety and depth of the papers given, and the audience was such as would have rejoiced his heart. The mix of academics and lay persons perhaps provides a clue to Sir Thomas's thinking about his proposed College, that it should be a meeting place where new ideas could be discussed freely and disseminated widely.

Gresham College is indebted to the Society for Renaissance Studies and, in particular, to Francis Ames-Lewis who both organized the conference and edited this splendid volume.

Introduction

Francis Ames-Lewis

This publication is one of several produced to celebrate the quatercentenary of the foundation of Gresham College in the City of London in 1597. Before offering some account of this collection of essays, I should explain how it came about and to whom its publication is most indebted. The papers published here are the majority of those delivered at a commemorative conference held on 20-21 March 1997, suitably enough at Birkbeck College, an institution which shares some of the educational ideals that have sustained Gresham College throughout its somewhat chequered history. The 'Gresham College 1597-1997' conference could not have been organized without the multifaceted support of Gresham College itself. Invaluable were the initial encouragement and suggestions of the late Professor Peter Nailor; crucial was the financial sponsorship proffered by the College Council through the good offices of its Chairman, Francis Baden-Powell; and throughout, the enthusiasm of Maggie Butcher who, with her energetic assistant Sally Bunyan, was ready to help in many practical and administrative ways, provided vital and warm-hearted encouragement at every turn. The smooth organization and running of the conference was largely due to Ken Carleton's administrative efficiency, and I am much indebted to him for his help.

Nor could the conference have taken place without the sponsorship and intellectual backing of the Society for Renaissance Studies and its Council, of which I was Chairman during the period of organizing and running the conference, and editing these papers. In respect of the Society for Renaissance Studies' input, I would like to highlight in particular the role of my colleague Dr J.V. Field, whose proposal it originally was that the Society might organize a quatercentenary conference around the theme of Gresham College and its founder, and to whom I turned frequently for ideas and inspiration. Thanks are also due to the British Academy whose financial assistance allowed us to import a scholar from abroad; and to Birkbeck College, University of London, for provision of accommodation and other facilities for the conference, and its Department of History of Art which has supported me in various ways during the editing of these papers. Heartfelt

gratitude is of course due to all the contributors to the March 1997 conference. All but three of their contributions are included in this book. Professor Lisa Jardine and Dr Joanna Woodall are publishing elsewhere the material that they presented, respectively on marginalia and occasional writings of Gabriel Harvey and Francis Bacon, and on the portraits of Sir Thomas Gresham. Sadly, we are unable to reproduce here the recital of music of Gresham's time, including works by John Bull, the first Gresham Professor of Music from 1597 to 1607, played on the virginals by the then Gresham Professor of Music, David Owen Norris, which brought the conference to a close. I am deeply grateful to all the contributors to this volume for their prompt and patient responses to my requests and enquiries; to those scholars who generously advised me in editorial matters, to my copy-editor Monica Thorp, and finally to John Smedley and Ruth Peters of Ashgate Publishing Limited, who have been courteously supportive of my editorial efforts as we have together seen the book into print. Finally, publication of this volume has been greatly assisted by a substantial subsidy from Gresham College, and we are once again very grateful to the College Council for their generosity.

That we know a good deal about Thomas Gresham and his financial and commercial activities will become clear from reading these papers, and especially the first three or four. Born around 1519, Gresham was, by the time Elizabeth I came to the throne in 1558, a successful merchant trading in particular in cloth with the Low Countries. From his father Sir Richard, Lord Mayor of London in 1537, Thomas inherited both his flair for business and in 1549 an already thriving cloth-trading company which he had, in fact, been directing already for several years. He conducted his operations with perhaps even more commercial acumen and imagination than his father and uncle had shown, and soon outstripped them in wealth. In 1551 Thomas Gresham was appointed Royal Agent to King Edward VI in Antwerp, managing the royal debt with great success and despite changes in religious policy serving not only Edward but also Mary I and Elizabeth I. For his services to the Crown Gresham was knighted by Elizabeth I in 1559, an honour unique to a citizen of London who had not attained the position of Lord Mayor, nor indeed ever became an Alderman. Inspired by the Antwerp Bourse, he established and constructed Gresham's Exchange, perhaps his best-known achievement, which was given both its current name and the royal seal of approval by Elizabeth I when she visited it in 1571.

Much is also known of Thomas Gresham's personal and domestic history. Throughout his life he maintained close links with the Mercers' Company, of which he became a member in 1543 and of which he was several times Master. In 1544 he married Anne Ferneley, the young widow of another wealthy London merchant, William Reade, and mother of two small boys. Although the date of birth of Thomas's illegitimate daughter, Anne is not known, there are records of expenditure on her from the late 1540s; and

she was married in 1569 to a member of the Bacon family. We also know about the only child of his marriage, Richard, who, tragically for his father, died in 1563 while still a teenager. We know a good deal about domestic life in the Greshams' various houses in the City, especially the new, grand mansion on Bishopsgate that they occupied for the first time in 1566, and in his estates and country houses in Norfolk, and later at Osterley in Middlesex.

But by contrast, perplexingly and frustratingly little is known for certain about the reasons and intentions that lay behind Thomas Gresham's desire to establish an educational institution, or his original ideas about its character and objectives. By the time he wrote his principal will in 1575, four years before his death, it was probably clear that his chances of generating another legitimate male heir to whom he could bequeath his estate and his ambitions for perpetuating the name of Gresham were becoming increasingly slim. Some other memorial, besides the Royal Exchange, to his achievement was necessary; and one that could be endowed from the income generated by the Royal Exchange after his wife's death. Although in 1571 he had toyed with the notion of establishing a college at Cambridge, he appears finally to have seen it as more appropriate to the furtherance of his particular interests in trade and commerce to set up an independent and innovative institution in his own city mansion. The few basic provisions written into his 1575 will included a list of the subjects in which the professors should be learned, and these - divinity, astronomy, geometry and music, law, physic and rhetoric - indicate that Gresham intended his College to have a curriculum distinctively different from those of the universities of Oxford and Cambridge. The range of his professors' scholarly fields is tilted in favour of practical subjects of particular importance for the conduct of trade, such as mathematics, geography, and navigation. Gresham himself, however, had nothing to do with the establishment of Gresham College, which had to await his wife's death in 1596, seventeen years after his own. At this point Gresham's estate was vested in the Corporation of London and the Mercers' Company, who were jointly responsible for appointing the seven professors and for establishing the Joint Gresham Committee which was responsible for administering the College.

Light is thrown on many of these historical questions - both of Thomas Gresham's life and career, and of the puzzles surrounding his intentions for the College - by the essays published in this book. But the net of the conference in March 1997 was cast well beyond the specific histories of Thomas Gresham and his College, to include consideration also of aspects of intellectual life in Elizabethan and Stuart London which fed into the curriculum of Gresham College (if it can be said to have had a curriculum in any formal sense of the term), and within which fields its professors might have had contributions to make. The first group of essays, however, deal

with historical questions. Ann Saunders' contribution considers the evidence of maps and printed panoramic views of London, on the basis of which the planning and the physical appearance of the City in around 1597 can be reconstructed. She focuses in on the parish of St Helen's, Bishopsgate, and in particular on Thomas Gresham's new house on Bishopsgate. The church of St Helen's still houses Sir Thomas's handsome marble tomb, described by Nikolaus Pevsner in his inimitable manner as having '... excellently understood classical details ... [without any] Elizabethan Mannerism or exuberance or barbarity...' ¹ At Gresham House Thomas and Anne Gresham established in 1566 their London domestic environment, making over the western wing of the large, quasi-collegiate courtyard to a series of almshouses for eight poor men. In this mansion in 1597 the College's seven professors were accommodated, each with his separate set of rooms. Here too, temporarily supplanting the Gresham professors, were accommodated the entire administrations both of the Corporation of London and of the Mercers' Company in 1666, since Gresham House was one of the few major buildings in the city to survive the Great Fire.

Thomas Gresham's career as a merchant-adventurer is surveyed by Ian Blanchard, who provides much detail on the patterns of trade of the Netherlands branch of the 'House of Gresham' which Thomas was in command of by 1546, then aged 27. He shows how Gresham combined his continuing mercantile activities with his royal appointment despite his claim to have closed his account books for ever. The Greshams' domestic arrangements both in London and in Norfolk are also outlined in some detail in this second essay, with descriptions of their dealings with the extended family, their household expenditure and life-style, and the effects on this life-style of their son Richard's death.

In her contribution, Vanessa Harding describes the 'social and political world' of Elizabethan London, considering its demographic structure, the governance of the City by the Court of Aldermen, the social and constitutional functions of the livery companies, and how 'the worlds of the companies and civic government interconnected' in the ruling class of London. Perhaps in part because of his lengthy absences in the Low Countries, however, Thomas Gresham played a much more low-key role in civic politics than others (such as his father and uncle) in his position, although 'all his temporal loyalties were focused on the city and on his company'. Dr Harding concludes that 'in his benefactions [Gresham] was seeking to establish his name indelibly as a civic benefactor'. Associated with this first group of essays is Margaret Pelling's discussion of the failure of the professorship of physic to make a significant impact on the practice of medicine in Stuart London. She concen-

¹ N. Pevsner, *The buildings of England: London I*, revised by Bridget Cherry (Harmondsworth, 1973), pp. 158-9.

trates less, however, on the later relationships between the activities of holders of the physic professorship and the London College of Physicians and other conduits for the development of the city's medical services, than on the features of Thomas Gresham's personal medical history that may have ensured the inclusion of physic as one of the seven subjects covered in his College's curriculum. She debates the possible reasons for the perplexing stipulation in Gresham's 1575 will that the College's professors be unmarried; considers the possible significance of Gresham's acquaintanceship with Dr John Caius; and discusses the 'apparent congruity between the Gresham ordinances and the physic College's statutes c.1601-02'. Finally, she considers in some detail Thomas Gresham's own medical history and medical attendants, focusing on the problem of his lack of a legitimate male heir and introducing the somewhat ill-defined episode of Gresham's late illegitimate offspring – a son born to one of his servants in 1576 – and its later implications. She concludes that 'his preoccupation with human continuity [may have guaranteed] the inclusion of a professor of physic in Gresham College'.

In the next two papers in this collection we are redirected to the first Royal Exchange: its position as the centre of activity in the insurance market, and Thomas Gresham's plans for its sculptural decoration. Trevor Sibbett, a professional actuary with a lifetime's interest in the history of insurance, discusses the origins and development of the insurance industry in Lombard Street and in the alleys to the north – leading up to the Royal Exchange – and south of that thoroughfare. He outlines the development of life assurance, enhanced by the studies of Bills of Mortality by John Graunt and William Petty, the third Gresham Professor of Music, and of marine insurance, stimulated by activities at Edward Lloyd's coffee house in Lombard Street; and he discusses the Office of Assurances, established in the Royal Exchange in 1576, and the foundation of Royal Exchange Assurance in the aftermath of the South Sea Bubble scandal. Destroyed with the first Royal Exchange in the Great Fire, the original series of thirty figures of Kings and Queens of England that embellished the building was closely replicated by the replacement series of the 1680s. Katharine Gibson suggests that in proposing a series of niched figures overlooking the courtyard, emulating the west façades of cathedrals such as Wells and Exeter, Gresham 'must have hoped to invest his new building with a similar, almost ecclesiastical, dignity'. Like the foundation of his College, Gresham's sculptural programme had to await the death of Lady Gresham and the establishment of the Joint Gresham Committee. Surviving evidence in the form of engravings and maquettes for some of the post-Fire figures, however, indicates that Gresham's plan was that his kings and queens should, perhaps predictably, be ostentatiously placed and splendidly polychromed.

The following groups of essays offer discussion of the cultural and intellectual context within which Gresham College was established by consider-

ing aspects of learning espoused by Gresham professors. Lynette Hunter, who is at the time of writing Gresham Professor of Rhetoric, discusses issues that were crucial to the social self-definition of citizens like Thomas Gresham, as opposed to those who moved in court circles: the question of 'appropriate behaviour and communication which was ... embedded in the teaching of rhetoric'. She argues that in the late Elizabethan period the development of a 'conversational rhetoric' took rhetoric beyond civic and economic life, and thence into the domestic context during the early Stuart period: it provided a process of reasoning by which 'the deceitful [could] be distinguished from the decent and decorous'. For a Thomas Gresham, skill in conversational rhetoric thus becomes an indicator of personal behaviour in his civic and economic world. Sarah Hutton's contribution explores the place of Platonism in Tudor intellectual life, and suggests that a link existed between Gresham College's intellectual culture and the 'Cambridge Platonism' developed especially at Emmanuel College. Knowledge of Plato was in fact sparse in Tudor England, in which university studies were dominated still by Aristotle. New early-Tudor collegiate foundations at Oxford and especially at Cambridge, however, gave increasing emphasis to Platonic studies. Eight of the nine early Gresham Professors of Divinity were Cambridge-trained: particularly noteworthy is Richard Holdsworth (Professor of Divinity from 1629 to 1637, when he was appointed Master of Emmanuel College) who in his Gresham lectures called Plato 'the most divine of philosophers'. Cambridge Platonism, Dr Hutton argues, flourished in the very period during which Gresham College's encouragement of the 'new science' of Hooke and Boyle stimulated the foundation of the Royal Society.

Developments in mathematical and astronomical studies in Stuart England which provide a context for the emphasis in the Gresham College curriculum on these practical subjects are considered in the next group of essays. Stephen Clucas discusses how 'the theoretical overcoming of the centuries-old alienation of mathematical and physical entities in natural philosophy' made possible the Greshamite promotion of the practical application of mathematics. He traces the movement, between 1570 and 1600, away from mathematical idealism towards a realism that directly related the mathematical and the physical. Crucial to the new interest in applied mathematics was the work of John Dee, who certainly saw mathematics and geometry in mystical terms but was also concerned with their application in practical areas such as land surveying. These tendencies were taken further by Thomas Harriot, notably in his work of the 1590s on kinetic and ballistic problems. The emergence of new ways of describing physical reality in mathematical terms, Dr Clucas concludes, cleared some of the ground for the development of the 'new physics' in the seventeenth century. Robert Goulding considers Henry Savile's endowment, parallel to (though rather later than) the establishment of Gresham professorships in geometry and astronomy, of chairs in these same subjects at

Oxford. Savile's professors were expected to include applied studies in their work: the professor of astronomy's nightly celestial observations were to be recorded for future research, and the professor of geometry was to teach 'practical geometry' and mechanics. Nevertheless, in his early lectures, delivered in 1570 at the time when Thomas Gresham was actively considering the foundation of his college, Savile argued strongly against practical mathematics. Deeply immersed in the history of mathematics, and especially of astronomy, from Euclid and Ptolemy to Copernicus, Savile seems to have despaired of the state of mathematical studies at Oxford. His lectures sought to correct this decline by arguing that, following Plato, the 'true worth [of mathematics] lies in allowing us a glimpse of the eternal, unchanging world of the Forms'. Fifty years later, however, in the statutes governing the work of the Savilian professors, he had recognized that 'unworldly Platonism ... is not the best recommendation for the sciences', and that mathematics should indeed also serve as a practical 'tool of merchants, instrument-makers and sailors' – a viewpoint with which Gresham would surely have been entirely sympathetic.

Mordechai Feingold reviews the arguments about the decline of Gresham College's teaching role, while maintaining that the professors of geometry and astronomy exceptionally made crucially important contributions both to theoretical studies and in practical applications in their fields. Contrary to some recent analyses, he suggests that 'this recreation of an Oxbridge enclave in London was instrumental in creating a scientific centre that might not have been possible had the College become just [a] training ground in elementary mathematics for artisans, merchants, and navigators'. Gresham professors like Henry Briggs and Henry Gellibrand were equally concerned with the 'textual study of mathematics' as was Henry Savile in Oxford; and it was the Gresham College lectures of Briggs and more celebrated followers like Christopher Wren that ultimately gave rise to the foundation of the Royal Society. Professor Feingold further argues that 'the Gresham professors, and other teachers of mathematics in London, and Oxbridge mathematicians [agreed] about the need to inculcate the principles upon which [scientific] instruments were constructed, and to ground practice firmly on art'. In conclusion, he discusses the changing relations between Gresham College and the Royal Society, which at first provided the College with a new *raison d'être* but which, when established in new premises after 1710, left it bereft of identity or purpose. Jim Bennett discusses the contributions of Christopher Wren to the study of astronomy and geometry while he was Gresham Professor of Astronomy (1657–61). Analysing in detail both Wren's known achievement while Gresham professor and in particular the programme he set out in his inaugural lecture, Dr Bennett shows that his achievement was fully in accord with Gresham College's emphasis on the practical applications of the sciences. His pro-

ductive use of increasingly sophisticated scientific instruments – the microscope and most obviously the telescope – allowed him to develop further the practical application of Henry Gellibrand's discovery, while Gresham Professor of Astronomy in the 1630s, of the variation of the variation of the earth's magnetism. This work promised both advances in planetary theory and, more significantly from the Greshamite viewpoint, a solution to the long-standing problem of devising a method for finding longitude at sea. Wren saw Gresham College as the natural focus for such developments in navigational techniques; and his work as Gresham professor also provided valuable foundations for his later activity as an architect, a 'branch of practical mathematics involving many of the Greshamite virtues – such as mathematics, practical application, instruments, civic service and public benefit'.

Architecture as a branch of practical mathematics is the theme at the heart of J.V. Field's paper, in which reasons for translating Sebastiano Serlio's vernacular architectural treatise, the principal sixteenth-century treatise that promoted the Italian practical tradition, are discussed. The 1611 translation into English was an example of 'the useful mathematical learning that Sir Thomas Gresham wished to encourage in England'. Dr Field lays stress on the practical applications of Serlio's books on geometry (for drawing the profile of a decorative urn, for example) and on perspective: this was especially helpful to a stage-designer like Inigo Jones, who owned a copy of the 1619 edition of Serlio's works. Serlio evidently believed that mathematics is useful and applicable: the 1611 translation indicates, Dr Field concludes, that following in the wake of the Gresham College programme some Englishmen agreed with him.

What then may we learn in general terms from the essays published in this commemorative volume? Thomas Gresham was clearly a man of great ambition, energy and wealth. Through the foundation of his Exchange he was, it seems, determined to establish London as a major centre of international trade and commerce, perhaps to supplant the Antwerp that he knew so well. Deeply disappointed in later years by the loss of his son and heir, Gresham made arrangements for the foundation of an innovative educational institution to perpetuate his name. The principal objectives of this College were to provide teaching notably in such practical subjects as physic, astronomy and geometry that would be of use especially to citizens of London who were involved in maritime trade and commerce. It may be that some of the instructions that Gresham laid down in his 1575 will, and that were incorporated by the Joint Gresham Committee into the 1597 College statutes, were counterproductive. The requirements, for example, that Gresham professors be unmarried, that they should be paid a not-ungenerous stipend, and that teaching should be free to all comers, may actually have discouraged high-quality teaching and – with notable exceptions such as Christopher Wren – the recruitment in all cases of the highest-

quality scholars to the professorships. Regular arguments between the professors and the College trustees, on issues such as whether lectures should be delivered in Latin or in English, suggest moreover a lack of trust and vision in the management of the College during the early seventeenth century.²

But it may also be that within a century of its foundation Gresham College had fallen victim to its own success. Although – or perhaps because – the evidence is not good in all areas, it might be possible to underestimate the extent to which the very existence of Gresham College was an important encouragement to research in practical subjects like astronomy for navigation, applied mathematics, and the ‘new science’ as developed by the likes of Robert Boyle. Certainly it is clear that, fostered by the opportunities provided by Gresham College, many of the early professors made emphatic contributions to these and other fields of ‘applied’ scholarship. The establishment and highlighting of these fields of scientific endeavour in turn fostered the foundation of the Royal Society in Gresham College in 1662. If its teaching mission was in many respects a failure, there can be little doubt of Gresham College’s significant position as encourager and facilitator for the advancement of the natural sciences in the early modern period.

² A good deal of information on these and other issues concerning the early history of Gresham College may now be gleaned from Richard Chartres and David Vermont, *A brief history of Gresham College 1597-1997* (London, 1998).

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Reconstructing London: Sir Thomas Gresham and Bishopsgate

Ann Saunders

By the second half of the sixteenth century, London comes out of the shadows. Which is not to say that we know nothing about medieval London. Plenty of buildings survive – Westminster Abbey, the Tower of London and Eltham Palace, for example; the City has retained its medieval street plan almost undisturbed until our own generation;¹ and we catch old, odd, disarming glimpses of it in drawings like the spire of Old St Paul's in a Matthew Paris manuscript,² or in a grand illumination to Charles d'Orleans' poems,³ which show him both as a prisoner in the Tower and as a free man riding away from it, or even in graffiti like the scratched outline of – once again – St Paul's on the tower wall inside the parish church at Ashwell in Hertfordshire. And of course, as far as archives and civic manuscripts are concerned, we have a collection as rich as, if not richer than anywhere in Europe. Work such as that undertaken by Derek Keene and Vanessa Harding on the Hustings rolls has made it possible to trace out the frontages all along Cheapside from the thirteenth century onwards. But in the 1540s it is as if the sun comes out, the mist rolls back, and we can actually *see* Dunbar's 'flower of cities'. For this we have to thank three pieces of evidence – a panorama, a group of maps, and a descriptive survey of the City of London. Let us deal with them in chronological order.

The panorama was the work of a Fleming, Anthonis van den Wyngaerde, and was probably executed in 1544. It is now in the custody of the Ashmolean Museum, Oxford, having come there as part of the Sutherland Collection which was garnered up in the early nineteenth century. It is executed in

¹ The first serious modern disruption of London's street plan came about when the Lower Thames Street tunnel and fast-way were driven through the riverside area. Lord Palumbo's development on the corner of Poultry and Queen Victoria Street will cover the churchyards of St Pancras and St Benet Sherehog, and will obliterate most of Bucklersbury, although it has certainly revealed much exciting archaeological evidence.

² British Library, MS Royal 14 C vii, f. 2.

³ British Library, MS Royal 16 F ii, f. 73.

brown ink on fourteen sheets of paper; it is a preliminary, working drawing for something more exact and probably larger, and frequent notes, intended to remind the artist of colours or of other details, are scribbled on it in Flemish. If we were to put all fourteen sheets together, we would have a panorama roughly 1' 8" high and 9' 4" wide representing London from Westminster Palace and the Abbey along the Thames to St Paul's and the Tower, and then telescoping the twists and turns of the river eastwards as far as Greenwich Palace and beyond. It is an amazing piece of work by any standards, and absolutely essential for our knowledge of pre-Fire London.⁴ It seems probable that it was drawn in 1544, towards the end of Henry VIII's reign. We do not know why Wyngaerde was in London, nor under whose auspices he executed the work. However, the chapel on London Bridge is firmly labelled 'S. Thomas Apostel', and it was in 1539 or 40 that Henry had ordered the dedication to be changed to this from its original one to St Thomas à Becket – a Londoner if there ever was one, born in Cheapside – since the saint and martyr had defied his King, Henry II, and was therefore not approved of by Henry VIII. Several buildings – the Whitefriars Church, the steeple of the Blackfriars Church, and Holy Trinity Priory, Aldgate – are shown, but all were gone or being demolished by 1544 or 1545. Wyngaerde was in England again a decade later, when his master Philip II of Spain was husband to Mary Tudor, and he then did a series of water-colour drawings of other palaces: Richmond, Greenwich and Hampton Court.

Why did he make these drawings? The original panorama remains a mystery, but the later drawings were probably on-the-spot studies for large wall-paintings to adorn the Pardo palace (now demolished), showing all the capitals over which the Hapsburgs ruled, and the palaces that they possessed. We do not know whether the panorama was ever translated into a huge wall-painting, nor do we know where the loose sheets of this unique, infinitely precious record of the London that vanished in the flames of 1666 were, nor how they survived, between the sixteenth and the nineteenth centuries.

Our second source of evidence is a group of three maps: the Copperplate Map of around 1557, Braun and Hogenberg's map of the City of about 1572, and the woodcut map of the City executed in the late 1560s, to which the name of Ralph Agas has become indissolubly attached. Of the Copperplate Map only two (fortunately contiguous) sections survive, showing London north and south from Shoreditch to London Bridge. They were retrieved separately from oblivion in the 1950s, and are now in the Museum of London. If we had all the plates – perhaps fourteen or sixteen of them – we

⁴ Oxford, Ashmolean Museum, DBB 5. The Panorama has been reproduced full-size by the London Topographical Society, with a biographical introduction by Susan Foister and a topographical introduction and keys by Sir Howard Colvin, publication no. 151 (London, 1995).

would have a most detailed map of London, some 3' 8" high by about 7' 6" wide. Perhaps other fragments will some day be discovered.⁵

Franz Hogenberg's engraved map view appeared in volume I of the magnificent atlas *Civitates Orbis Terrarum* which he and Braun issued in 1572, although the drawing for it was probably made more than ten years earlier, since it shows St Paul's with its spire that was destroyed by lightning in 1561.⁶ It is an exquisitely detailed engraving, amazingly precise though small in scale.

There remains the woodcut map, which is the one that tells us the most.⁷ It cannot in fact be by Ralph Agas: it is not in his style, and he could not have been more than twenty when this map was made. However, his name is so firmly attached to it that it would only cause confusion to call it by any other. It was printed from wooden blocks which have not survived, and it exists in three copies: a good one in the Guildhall Library (Prints and Maps Department), a tatty one in the Public Records Office, and a moderately good one in the Pepysian Library, Magdalene College, Cambridge. Laid out complete, it measures 2' 4" by 6' 0". It shows the spread of the city from Westminster Abbey and Lambeth Palace to the Tower and what is now known as St Katherine's Dock. It is fairly crudely executed, but it provides an enormous amount of information and it is fascinating to compare details in it with what can be seen in Wyngaerde's panorama. The monastic buildings are vanishing, as progressively they were overwhelmed and put to the uses of the secular world.

Finally, there is John Stow's Survey of London, first published in 1598, the year that Burbage and his company (Shakespeare among them) moved the threatened Globe Theatre from its site in Shoreditch across London Bridge to the safety of Southwark.⁸ It is an enormous, detailed and overflowing book, and Stow must have laboured on it for years. He says himself that it has cost him 'many a weary mile's travel, many a hard-earned penny and pound, many a cold winter night's study', but he left a fine legacy to posterity. The Survey starts with a description of London as eloquent and as loving as that penned by William FitzStephen before the end of the twelfth century - and considerably longer. Stow tells of the city's antiquity and its geographical position, in particular its water supply; he lists its orders and customs, its sports and pastimes; he dwells on the honour of the citizens

⁵ For the northern half of the Copperplate Map, see M.R. Holmes, *Moorfields in 1559* (London, 1963), and *ibid.*, 'An unrecorded map of London', *Archaeologia* 100 (1966), pp. 105-28. For the southern half, see the entry in Sotheby's sale catalogue, 22-3 July 1985, lot 393.

⁶ Good reproductions are easily obtainable from the Museum of London.

⁷ See *The A-Z of Elizabethan London*, compiled by A. Prockter and R. Taylor, with introductory notes by J. Fisher; London Topographical Society 122 (London, 1979).

⁸ John Stow, *A survey of London*, reprinted from the text of 1603, with introduction and notes by C.L. Kingsford, 2 vols (Oxford, 1908).

and the worthiness of the inhabitants; and he proceeds to a ward by ward, street by street, description of the whole of London as though the reader is walking through the streets beside him and seeing with his eyes. Gresham College has a whole page to itself, for in 1598 its establishment was hot news. Stow must almost have interpolated his account of the College into his completed text, for the first lectures had only been given in June of the previous year. He writes in the present tense:

These lectures are read dayly, Sundayes excepted, in the terme times, by euery one vpon his day, in the morning betwixt nine and ten, in Latine, in the after noone betwixt two and three, in English, saue that D. Bull is dispensed with to reade the Musicke lecture in English onely vpon two seuerall dayes, Thursday and Saterday in the after noones, betwixt 3. and 4. of the clocke.⁹

He lists the first team of lecturers:

Whereupon the Lecturers were accordingly chosen and appointed to haue begun their readings in the Moneth of June, 1597. whose names were *Anthonte Wootton* for Diuinite, Doctor *Mathew Guin* for Phisicke, Doctor *Henrie Mountlow* for the Ciuill law, Doctor *Iohn Bull* for Musicke, *Brerewood* for Astronomie, *Henrie Brigges* for Geometrie, and *Caleb Willts* for Rethoricke;

and as can be seen he has not had time to ascertain Edward Brerewood's Christian name, so great was the hurry to get to press. Thereafter, throughout the entire sizeable *Survey*, whenever Gresham's name is mentioned reference is made to the College as well as to the Royal Exchange. Stow obviously felt that the one was as important to the City as the other, and he had no doubt about the importance of the lectures: Gresham's bequest had been confirmed by Parliament and the discourses were 'so to continue for ever'.

Stow's account is obviously full of pride and excitement; but what hard evidence is there on which a reconstruction of the physical setting of Gresham College in Bishopsgate can be based? The map reproduced in Fig. 1 shows Gresham College set between Bishopsgate and Broad Street, just a short distance to the north east of the Royal Exchange. Those buildings were once Thomas Gresham's own home, where he lived with Lady Gresham, born Anne Ferneley, the widow of William Reade, Mercer, by whom she had two sons, the younger of whom Gresham brought up.¹⁰ Here they were, unwillingly, forced to entertain Lady Mary Grey, Lady Jane's younger sister, from 1569 to 1572, after her indiscreet marriage for which Queen Elizabeth ordered her to be held in dignified but strict confinement. The Greshams moved to Gresham House in 1566, the year that work began on building the

⁹ Ibid., I, p. 76.

¹⁰ The fullest account of Gresham's life is still J.W. Burgon, *The life and times of Sir Thomas Gresham*, 2 vols (London, 1839).

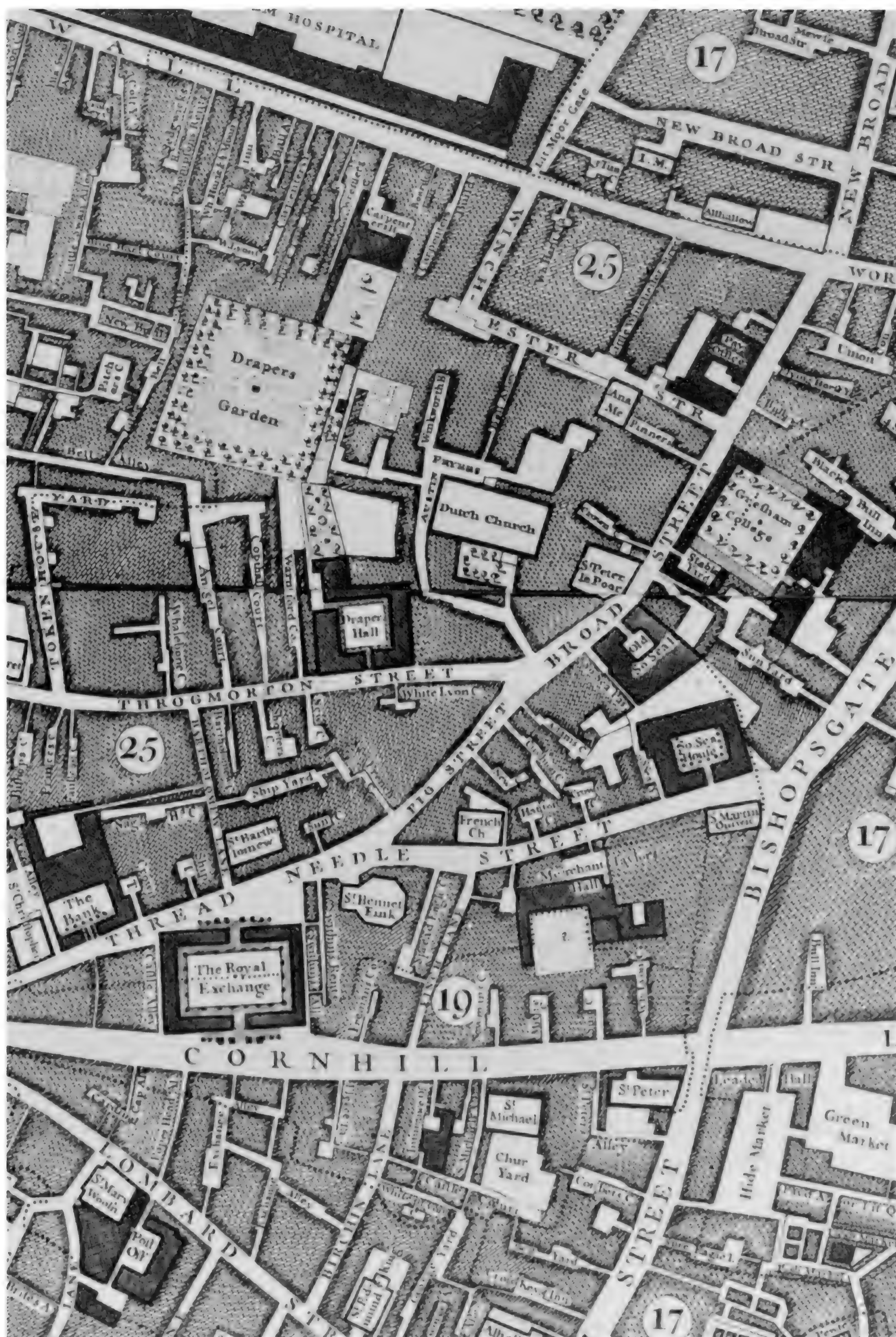


Fig. 1. John Rocque, Plan of the Cities of London and Westminster, published in 1747. Detail showing area between the Royal Exchange and Gresham College on Bishopsgate. Guildhall Library, Corporation of London.

Royal Exchange, so the grand house in Bishopsgate can never have been a home to young Richard Gresham (the one child that Thomas and Anne Gresham had had together), for he had died aged 16 on 2 May 1563, thereby blighting his father's hopes of establishing a Gresham dynasty. At the time of the youth's death the Greshams were living in a substantial but probably rather hemmed-in house in Lombard Street, the site of which was later occupied by Martin's Bank – hence the adoption of the Gresham grasshopper as that bank's symbol.¹¹ At about that time Gresham acquired a substantial plot of land – close on an acre – in Bishopsgate, and on this he built a mansion with a great courtyard behind it and a row of almshouses for eight poor men on the western boundary facing on to Broad Street. It was here that he entertained Queen Elizabeth on 23 January 1571 prior to her visit to his Exchange which she, honorifically but provokingly, re-named the Royal Exchange; and it was this building that he destined for a new existence, after his own and Anne's deaths, as Gresham College. Today the National Westminster Tower stands on the site, but we have three pieces of evidence, besides the indications provided by the Agas map, for reconstructing the original appearance of Gresham College.

The first item, in chronological order, is the account in the Gresham Repertories (the minutes of the Joint Grand Gresham Committee) of the allocation of the professors' apartments to provide accommodation after the Great Fire for the officials of the City Corporation and the Mercers' Company. The second (Plate 1) is the engraving by George Vertue of the College buildings which served as an illustration to John Ward's *Lives of the Professors of Gresham College*, published in 1740. Finally, the third piece of evidence is a set of measurements of the site written into the Act of Parliament of 1768 whereby the Gresham Committee was authorized to sell the buildings and site of the College so that a new Excise Office could be built there. No valuation was put on the property, but it was agreed that the Government would pay £500 in perpetuity to the City Corporation and the Mercers' Company, although the Mercers had to contribute £1,800 towards the demolition of what were, in effect, their own buildings. The folly of disposing of an asset of such value was due in part to the behaviour of the professors, who were seen as a group of argumentative, lazy layabouts (the academic body had declined somewhat from its days of glory at the time of Wren, Hooke and the nurturing of the Royal Society); in part to the City's anxiety to keep the Excise Office within the Square Mile; and in part to the

¹¹ The grasshopper was in use as the family crest as early as 1462, when it appears on the seal to a Gresham letter among the Paston correspondence in the British Library. The reason for the emblem is not known: the most likely explanation is the resemblance between the name of the family (and their Norfolk village) and the word *gressop*, Middle English for grasshopper.

financial crisis that the Mercers had brought upon themselves through unwise involvement in a ill-calculated scheme to provide pensions for clergy widows. Their entry into this scheme, it should hastily be said, was occasioned by the Mercers' Company's debts that resulted from the rebuilding of the Royal Exchange; while the City enjoyed support from the Coal Tax towards its overwhelming expenses, the Company received no such benevolent largesse but struggled along – honourably – on its own. However, the story of Dr Assheton's Annuity Scheme and the Mercers' misfortunes would provide the subject-matter for a whole lecture, and is outside the scope of this essay.¹²

It is clear from the view of Gresham College reproduced as Plate 1 that a very narrow gatehouse led out into Bishopsgate on the east side of the site. Presumably Gresham had failed to acquire a substantial frontage onto the main thoroughfare; so it would be more correct, perhaps, to speak of Gresham House being behind, rather than in, Bishopsgate. Immediately beyond the entrance to the College was the professors' Reading Hall, which must have been Gresham's Great Hall in which he had entertained the Queen.¹³ (The tablecloth used on that occasion is still the treasured possession of the Guardian Royal Exchange Assurance Company.) To the left of the Great Hall the professor of music had his lodging; to the right, on the south side, was the professor of physic. Given both their position and the arrangement of their windows, it may be that these rooms were the immediate family's particular apartments, where old Lady Gresham would have spent her time when in London after Sir Thomas's death. On the roof, in the south-east angle of the great courtyard, is marked an observatory, added in the 1670s.

The buildings described so far were old-fashioned enough: the Great Hall, for example, was of the type that survives in Crosby Hall, Sir John Crosby's house built three quarters of a century earlier that stood just down the road from Gresham House. Denied a main road frontage, Gresham House is unlikely to have had the sort of splendid façade that survives in the Victoria and Albert Museum from Sir Paul Pindar's mansion in Bishopsgate. There is nothing to suggest that Hendryck van Paesschen, the Antwerp architect employed by Gresham to design and construct the Royal Exchange, worked also on Gresham's own dwelling. With its elegant Classical doorways and its imposing southern entrance on Cornhill, the Exchange was the marvel of its own and subsequent generations. There was nothing else so modern, so

¹² For this episode, see I. Doolittle, *The Mercers' Company* (London, 1994), ch. VII.

¹³ We know that at that memorable repast in January 1571 the Queen was accompanied by the French Ambassador, de la Mothe-Fenelon (the uncle of the philosopher of that name) and by Cardinal Châtillon, who had stayed with Gresham at Osterley in the previous year; see J.H. Baker (ed.), *Notebooks of Sir James Dyer*, Selden Society, 109 vols (London, 1994), I, p. 195. I am most grateful to Professor J.H. Baker for this reference.

sophisticated, so European in London. However, Gresham kept to a medieval arrangement for his own house – a great hall with adjacent domestic buildings – and did not set himself apart from his fellow citizens by building himself a Renaissance palazzo. He could have afforded it, and he chose the new architecture for his Exchange – but he clearly preferred a conventional London residence for himself, just as, both in London and at Inwood in Norfolk, he cheerfully chose to keep up hospitality to all comers, high or low, as his father, Sir Richard, had done before him.¹⁴

Unusual, however, is the Green Court behind the primary group of buildings that make up Gresham House, and this courtyard suggests that Gresham may for a long time have had the idea in his head of establishing a College. Even the descriptive name 'Green Court' whispers to us of leisurely academic life, and although we cannot be certain it is at least possible that that name was in use already in Gresham's day. It is also noticeable that the stables are set away from the Green Court, and probably did not have access to it. This is essentially a college quadrangle, shut off from the commercial world by the narrow Bishopsgate entrance and sheltered on the other, Broad Street, side by the almshouses. The north, south and east ranges of the courtyard are for all the world like the collegiate buildings that they later became. The professor of geometry had the south-eastern corner with the professor of divinity as a neighbour on the first floor and the professor of physic's laboratory on the ground floor (as noted earlier his lodgings were in the main building). The professor of rhetoric was in the south range and the professor of astronomy in the north, at some distance from his observatory, while the professor of law had the southern end of the west side with the almshouses – which was rather near the stables, but at least he had his own front door which gave him some privacy. Sir Thomas would have needed a mansion of this size, for his was a sizeable household; but the area of the property was little, if at all, greater than the London inns or residences of the more powerful medieval nobles or the loftier ecclesiastics.¹⁵

More information about Gresham House may be teased out from the other two sources of evidence, the Gresham Repertories and the Act of Parliament that led to the destruction of the old building. In the aftermath of the Great Fire – those four terrible days of 2–5 September 1666, which

¹⁴ For this, see Ian Blanchard's contribution to this volume, on pp. 18–21.

¹⁵ For discussion of such properties, see C. Barron, 'Centres of conspicuous consumption: the aristocratic town house in London 1200–1550', *The London Journal* 20/1 (1995), pp. 1–16; and further, C. Barron and A. Sutton (eds), *Medieval London widows 1300–1500* (London, 1994). Also useful are J. Schofield, *Medieval London houses* (London, 1994), and M. Wood, *The English medieval house* (London, 1965; 2nd edn, 1990). An impression of the area required by such an establishment may be obtained by glancing into Stationers' Court, off Ludgate Hill, which occupies the site of the Countess of Pembroke's London lodging, later Abergavenny House. For Gresham's domestic life, see again Ian Blanchard's contribution to this volume, on pp. 17–23.

wiped out more than four-fifths of the medieval City, doing far more destruction than the bombing of World War II and leaving only a nail-paring of intact buildings in the City's north-eastern corner - the Corporation and the Mercers were unbelievably fortunate that Gresham College was among the few buildings spared, along with St Helen's, Bishopsgate, St Andrew's Undershaft and St Olave's, Hart Street with Samuel Pepys' dwelling that served as the Admiralty Office nearby. Into the College they proceeded to cram the whole administration of both Corporation and Company, as well as the tenants of the Royal Exchange. If Gresham College had not been spared we cannot guess where or how the City would have set about the rebuilding of London. In Gresham College the City officers had a secure base from which to operate, however improvised and uncomfortable their offices may have been. The Joint Gresham Committee met for the first time on 18 September 1666; the entry in the Repertories for that meeting is short:

The Committee having taken into consideration how they may accomodate the publique concerne for the City and Company in the house [i.e. Gresham House] in this time of publique Calamity and how they may dispose of the residue thereof as well for the Accomodation and keeping together of the Exchange Tenants as for the raising of rents for supply of the uses of the founder...¹⁶

A sub-committee was appointed to allot spaces within Gresham House for the use of the City and Company dignitaries and officers. Sir John Lawrence, Sir George Smith and Deputy Cade were appointed for the City, Sir Richard Ford, Richard Clutterbuck and Rowland Wynne for the Mercers. A quorum of four - Smith, Cade, Clutterbuck and Wynne - assembled the next day and duly allocated the available space. Gresham House was large, but it would be difficult to fit in the whole administration of the City and its leading Company, as well as to provide shop space for all those tenants about the Pawns¹⁷ who were determined to continue trading. The Sub-Committee 'viewed all the lecturers lodgings and the publique roomes, the warehouses, cellars, stables, haylofte, shedds & other buildings in and about Gresham College', and they allocated spaces as fairly as they could. The Lord Mayor was allotted the professor of divinity's lodging and the Chamberlain of London received the Gallery. The City Recorder was given two large Common Rooms and Dr Horton's rooms, and the Mercers' records could be

¹⁶ Mercers' Company Archives, *Gresham Repertories*, II, p. 227; pp. 228-31 give details of the allocation of rooms.

¹⁷ The Pawns were the galleries, lined with tiny shops, which ran round the upper level of the Royal Exchange. For a full account of that building, see A. Saunders, 'The building of the Exchange' and 'The organisation of the Exchange', in Ann Saunders (ed.), *The Royal Exchange*, London Topographical Society 152 (London, 1997), pp. 36-47 and 85-98.

stowed either in the four rooms of the professor of civil law or in the three belonging to the professor of rhetoric. The Aldermen who had passed the Chair, 'respect being had to their seniority', had to manage in Dr Goddard's kitchen and two lavatories, sharing them with the Assurance office and being promised a public room when a Court was held; the Common Sergeant and four attorneys had to squeeze in together. The main quadrangle could be divided into a hundred shops for the tenants of the Upper Pawn – we may guess that, at least at first, they set up stalls – and the covered walk 'in the centre next Bishopsgate' was divided into seven compartments for Thomas Culing, Esq., Rowland Worsopp, Mercer, Mr Henry Mosse, Major Wright, Notary Public, and presumably three others. The stables and hayloft

if cleansed and fitted may serve for the Judicature if occasion should require, and if not, then divided into shops and lodgings, and to be disposed of for rent, to the best Advantage, ... [while] We conceive that the best profit ought to be made of the Greate Warehouse and the severall cellars belonging to the house on condition noo carte be suffered to come with the Gates.¹⁸

No specific area was set aside as a public meeting place, but perhaps in such an emergency it was felt that none would be needed. To judge from later regulations, the main quadrangle seems to have served the purpose. Some sort of order was imposed on the chaos with remarkable speed. The almsmen's stipends were raised to £10 per annum, but they were told to find themselves lodgings elsewhere so that their dwellings could be used to better advantage. The only space left undisturbed was the Astronomy Laboratory, which was to 'bee left as now they are, in regard of the many curiosities which remaine there and that the Royal Society may have accomodacion there for their meetings'. Otherwise, every available corner was to be used to its fullest potential, and any rents that could be raised needed to be gathered in. Everyone realised that the rebuilding of the Exchange would cost an intolerable amount of money, but that it was unthinkable not to restore London's pride.

Throughout the next three years Sir Thomas's College served his other foundation, the Exchange, and indeed the whole City remarkably well. Between that first meeting on 18 September 1666 and the last triumphant one on 2 August 1669 when the rebuilding work on the Royal Exchange was almost complete, there were 111 sessions either of the Joint Gresham Committee or of the special Sub-Committee for Rebuilding. Fifty-four City worthies – Lord Mayors, aldermen and councillors – joined in the deliberations, and most meetings took place in Gresham College. A notice was put in the Gazette for March 1667 that the Committee would assemble each Monday

¹⁸ Mercers' Company Archives, *Gresham Repertories* II, p. 230.

morning at the end of the Long Gallery, and that any workmen needing instructions could receive them there – although towards the end of the period there were gatherings on the building site that was to be the resurrected Exchange.

During those three years the old house (by 1666 Gresham's mansion had reached its century) must have taken a battering. The Green Court, which must have been its original owner's pride and joy, was paved over (probably fairly roughly) at a cost of £40. The carter who brought the 'bricks and rubbish for paving ye Great Quadrangle for ye Meeting of the Merchants' was told to apply to the tenants, the 'Exchange men', for his money, but they were slow to pay.¹⁹ A large passage was knocked through to Bishopsgate, and a vault was sunk, presumably in the courtyard or in the stable block, to provide a house of office, for complaints came in about the 'noysome noyse' of the dung hill.²⁰ There was constant coming and going, complaints over accommodation, over leases, over rents, and over many other issues; and there were regular anxieties about keeping horses and carts out of the main courtyard. Finally the work was complete, however, and the Royal Exchange re-opened on Lady Day 1671. The tenants reoccupied it eagerly, at least for the time being; before long, however, whole galleries would be empty as elegant trade moved westward, and the Royal Exchange Assurance Company and Lloyd's moved in. At this triumphant moment Gresham College was free to refurbish itself with new curtains for the windows – Samuel Purchas supplied seventeen yards of 'stuf for the cummitey room' – and the almsmen moved back into the almshouses and were provided with new gowns of 'sad coloured mixt cloath' with a grasshopper embroidered on each in gold silk.²¹ On 1 December 1673 the Royal Society was welcomed back to the premises: the company drank six quarts of each of canary, of Rhenish wine, and of claret, and were regaled with four and a half pounds of fine cakes, two pounds of small 'macheroones', and two pounds of small marchpanes. The whole bill, with portage, coals and hire of plate, totalled £2 17s 9d, and the College was back in business once more.²²

The lectures continued, with sporadic squabbling, for another century. By the mid-1770s the building was showing its age and hard usage. The Excise Office, which had occupied various City premises since the Fire (some of them associated with the Mercers' Company), was in need of new and modern accommodation. In 1768 an Act was put through Parliament authorizing the acquisition and demolition of Gresham College, and its replacement with a new Excise Office. As has been noted, the Government

¹⁹ Ibid., II, p. 254.

²⁰ Ibid., II, p. 264.

²¹ Corporation of London Record Office, Royal Exchange, Misc. MSS 133.6.

²² Ibid., Misc. MSS 135.31.

was to pay in perpetuity £500 per annum in quarterly instalments to the City and the Mercers' Company; the latter, however, were required to pay £1,800 towards the costs of demolition of the old building. The lectures were to continue thereafter to be held in the Gallery of the Royal Exchange; since their residential accommodation no longer existed, the professors were permitted to marry. The Act of Parliament gives a set of measurements for the ground acquired which, plotted out, correspond with the outline of the Gresham College building as shown on the Ogilby and Morgan map of 1676, and on Rocque's map of 1745.²³ Sir Thomas Gresham's house thus vanished after two centuries of existence during which it had served its builder, his Company, the City of London, and scholarship at large both faithfully and well.

²³ Act of Parliament, 10 March 1768, 8 Geo. III, c. 32.

Author's note: since this paper was delivered, a third section of the Copperplate Map was discovered in Germany in 1997. A short account of this was published in the London Topographical Society Newsletter for May 1997; it is hoped that something fuller will be published in the *London Topographical Record* in 2000.

Sir Thomas and the 'House of Gresham': activities of a mercer-merchant adventurer*

Ian Blanchard

In 1543 Thomas Gresham ended an eight-year apprenticeship to his uncle John and was admitted a member of the Mercers' Company. As he himself later explained, this was a somewhat unusual course of events as 'I need not have bynne prentisse for that I was free by my Father's coppinge: albeit my Father Sir Richard Gresham being a wyse man, although I was free by his coppinge, it was to no purpos, except I was bound prentisse to the same; whereby to come by the experience and knowledge of all kinds of merchandise.'¹ Yet due to this paternal foresight, by the time of his admittance to the Mercers' Company, although he continued to operate in the shadow of his father, Thomas had so thoroughly acquired that requisite 'knowledge of all kinds of merchandise' that he was well on the way to becoming the *de facto* head of the Netherlands branch of the commercial operations of the 'House of Gresham'. Before he could assume, in 1546-47, this mantle fashioned for him by his father, however, he had one major obstacle to overcome. On 3 March 1545 Secretary Paget wrote from Brussels that Thomas, then trading in his own right, was one of the English merchants whose goods had been seized by order of Charles V. In a section of his letter which is worth quoting in full he also explained why the Greshams, because of their particular activities, were likely to survive this disastrous turn of events.

Some in dede shall win by it (the seizure); as William Lok, Sir Richarde Gressam and his sonne (Thomas), and William Gresseme, with such other for

* This paper draws heavily on materials more fully discussed in I. Blanchard, 'Thomas Gresham, ca. 1518-1579', in Ann Saunders (ed.), *The Royal Exchange. Essays on the history and topography of a London institution*, London Topographical Society 152 (London 1997), pp. 11-19, and to be published in the biographical essay 'Sir Thomas Gresham' prepared for the *New Dictionary of National Biography*.

¹ *Calendar of State Papers, Foreign Series ... preserved in the State Paper Department of Her Majesty's Public Record Office*, ed. W. B. Turnbull (vols 1-2) (London, 1861). Henceforth referred to as *SPF*, 1547-53, no. 655.

the most parte that occupie sylkes, who owe more than they have here. But Mr Warren, Mr Hill, Chestre, and dyverse others a greate nombre, ar like to have a greate swoope by it; having muche here, and owing nothing or little.²

And so it was. Like those other mercers who for 'the most parte ... occupie sylkes' Thomas had already received delivery of these goods in time for the Paasche (Easter) mart.³ Although their suppliers might dun them for payment, lacking alternative customers for their wares, they were unlikely to follow such a drastic course of action, particularly as these mercers had nothing at Antwerp on which to distrain. The Italian silk dealers knew that the money needed to pay for their wares would only be available when merchants like the Greshams had sold the cloths despatched to them at Antwerp, and others had been able to honour their bills of exchange from the proceeds of their own cloth sales. Until that occurred they would simply have to grin and bear it. Thomas thus emerged out of the crisis virtually unscathed to assume in 1546-47 the headship of the Netherlands branch of the commercial operations of the 'House of Gresham'.

MERCER AND MERCHANT ADVENTURER, 1543-63⁴

In three short years following his admission to the freedom of the Mercers' Company in 1543 Thomas Gresham had fulfilled every aspiration that his father had of him. During this period he was entrusted by the Crown with increasingly delicate tasks on the Continent. Also at this time he assumed headship of the Netherlands branch of the commercial operations of the 'House of Gresham'. This involved him, as it had his father, in the 'normal' mercers' trade, buying silks such as velvet, satin, taffeta and sarsenet which together with fine woollen cloths and tapestries commanded a ready market in London. Also like his father his other speciality was the importation of armour and weaponry which was designated in his accounts as 'harness'. To pay for these wares he continued, moreover, to follow the time-honoured

² *Letters and papers, foreign and domestic of the reign of Henry VIII*, ed. J. Gairdner (vols 12/1-13/2), J. Gairdner and R. H. Brodie (vols 15-20/2) (London, 1890-1907). Henceforth referred to as *L&P Henry VIII* XX (1), 303.

³ The Netherlands Fairs began at the following times: Paasche Mart - third week of April; Sinxen Mart - second week of June; Bamus Mart - third week of September; Cold Mart - early November. In this instance, however, the official opening was largely irrelevant to the English, trading operations beginning in January.

⁴ The following description of Thomas Gresham's career as a mercer and merchant adventurer is based on the London particular customs accounts - PRO. E122/81/32A (1544/5); 85/3 (1546/7); 167/1 (1547/8); 85/7,11 (1548/9); 85/9 (1549/50); 84/8 (1550/1); 84/9 (1551/2); 84/12 (1552/3); 86/2-87/4 (1553/4); 86/6,7 (1556/7) and E101/347/16 (1546/7) - and on his own day book for 1546-51, preserved at the Mercers' Company. The data from this volume has been entered on an Ingres database system, developed at Edinburgh University with funding from the ESRC [grant R-000232851].

practice of either putting over the necessary moneys on the exchange or exporting English woollen cloth. In pursuing this trade Thomas had by 1545 already become the leading force in the company's operations, in spite of Paget's diplomatic use of a juvenile appellation in his description of him. Following the lifting of the restraint on the English merchants' goods at Antwerp on 6 April in that year⁵ he was responsible for over 90 per cent of the company's goods shipped from the mart: four chests and a pack containing fifty pieces of velvet (1,117 yards) and twenty-two pieces of taffeta (873 yards); six sacks of cotton and six vats of 'harness', officially valued at £1,394. The transition to his *de jure* headship of the company's Netherlands operations in 1546-47 was thus accomplished with considerable ease. In that year he was again solely responsible for the company's purchases of mercery and 'harness' at the Netherlands marts and for the shipment of these wares to London. Most of the company's woollen cloths (1,025 'cloths' or 75 per cent of a total of 1,375 'cloths') despatched from London to the Netherlands to provide cash for the purchase of this mercery were also registered in his name. The older generation of Greshams now contributed only diminutive quantities of textiles - Sir Richard and William 100 'cloths' each and Sir John 150 - to the company's exports and received from Thomas's hands a correspondingly diminutive share in the company's mercery imports. Long groomed for the task, Thomas had now replaced his father as head of the Netherlands branch of the 'House of Gresham' and was to continue in that position until his assumption of the post of Royal Agent in the Netherlands in 1551/2.

Yet his situation during the years 1546-51 was a very different one from that in which his father had found himself some twenty years earlier. Successive debasements of the English silver coinage by the profligate Henry VIII and his son had led to the emergence of a system of bimetallic premiums on the Anglo-Netherlands exchanges which in enhancing the cost of commercial credits had resulted in the overpricing of English textiles at the Netherlands marts. In response to this phenomenon, Thomas, like many of his peers, altered the composition of his company's commodity export mix, replacing traditional long and short cloths with the light-weight, and cheap, kersey. In 1546-47 kerseys made up almost half (635 'cloths' or 46 per cent) of the company's exports, only marginally ceding ground to the short cloths (661 'cloths' or 48 per cent), which remained the staple of the elder generation's trade, and completely displacing the luxurious longs (71 'cloths' or 6 per cent). Yet in spite of this initiative on his part the company's woollen cloth exports during the years 1546-51 never attained a level amounting to more than 60 per cent of that achieved by the 'House of Gresham' in 1535.

⁵ *L&P Henry VIII* XX (1), 494.

Thomas accordingly had to resort to other means to generate the necessary cash flow for the purchase of mercery and 'harness' at the Netherlands marts. Like other members of the family he dabbled in the monastic lead trade, the very low price of the base metal at this time ensuring its ready sale on continental European markets.⁶ Moreover when in 1548-49 the Mair-Fugger consortium was able to monopolize Bohemian tin production⁷ and, with the support of King Ferdinand, was able to exclude Saxon and English competition, thereby raising tin prices to a level some 40 per cent higher than those prevailing on the free market, Thomas responded rapidly to the new situation. His servant John Elliot intensified his activity in Cornwall acquiring tin supplies which after their shipment to London were exported to the Continent. Thomas thus supported a trade which for some eighteen months, before the collapse of the German consortium and resultant fall in tin prices, made a significant contribution to the company's coffers. During the years to 1549 he also performed small services for his uncle, Sir John, and for his father, Sir Richard, in their continuing operations for the Crown on the Anglo-Netherlands exchange.⁸ By such means, for some five years (1546-51) Thomas secured for the 'House of Gresham' a premier place in Anglo-Netherlands commerce.

On securing the post of Royal Agent in the Netherlands during the winter of 1551/2, he then - according to his own account - closed the account book in which he had recorded all his business since 1546 and finally turned his back on his mercantile activities.⁹ Like so many other such statements written by Thomas in a spirit of self advertisement, however, this was only a half-truth. With the exception of Robert Berney, those factors and agents who had served him well as a merchant remained in his service after the winter of 1551/2. These members of the mercantile network, augmented indeed on occasion by others, retained sufficient mercantile connections that when requested by their master to undertake some small commercial favour for his political patrons they could fulfill his instructions with ease.¹⁰

⁶ I. Blanchard, *International lead production and trade in the 'Age of the Salgerprozess' 1460-1560* (Stuttgart, 1995), pp. 162-3, 167-74.

⁷ On the activities of this consortium see H. Kellenbenz, 'Sächsisches und böhmisches Zinn auf dem europäischen Markt', in H. Kellenbenz and H. Pohl (eds), *Historia Socialis et Oeconomica. Festschrift für Wolfgang Zorn zum 65. Geburtstag* (Stuttgart, 1987), pp. 246-50.

⁸ *Acts of the Privy Council of England*, ed. J. R. Dasent n.s. I-VII (London, 1890-93). Henceforth referred to as APC 1542-7, 161, 224, 274, 329, 386, 415, 417, 423, 437, 453, 461, 501, 563. Ibidem 1547-50, 10, 85, 170, 179.

⁹ Memorial, 16 August 1553, quoted from BL Cott. MS. Ortho E x, f.43, by J.W. Burgon, *The Life and times of Sir Thomas Gresham compiled chiefly from his correspondence preserved in Her Majesty's State-Paper Office: including notices of many of his contemporaries*, 2 vols (London, 1839), I, pp. 115-20 and SPF 1553-8, 105.

¹⁰ For example, SPF, 2 January 1558/9.

Far more telling of Thomas's continuing mercantile connections at this time, however, were his actions during those periods (July–November 1553 and March 1556–December 1557) when, possibly as a consequence of the intrigues of the Lord Treasurer,¹¹ he lost his post as Royal Agent and was consigned to the political wilderness. On each of these occasions he simply resumed his activities as a merchant. Thus having continued in the craft of mercer-merchant adventurer until 8 December 1551, when he received at London his last shipment of 'harness' from the Netherlands, Thomas then, as he himself declared, left 'my occupying and whole trade of living for the space of two years'. Yet with his fall from grace in July 1553 he was able immediately to pick up his old trade, buying some 308 'cloths' that summer for shipment to the Netherlands at the Cold Mart. Thomas's ability to resume the threads of his earlier life on this occasion with such ease belies the self-proclaimed discontinuity in his career associated with his assumption of the office of Royal Agent in December 1551. Indeed, it would be to impose an anachronistic functional division upon the activities of Thomas and his team to perceive them as uniquely merchants or uniquely financial agents. They were both. The 'House of Gresham' did not close its doors in December 1551. It merely underwent a metamorphosis as its head, Thomas, added a range of new activities to his old. Whatever the source of his income, however, from 1543 Thomas was by contemporary standards becoming a rich man.

DOMESTIC AND BUSINESS ARRANGEMENTS, 1544–63¹²

Already in 1544, when such status and wealth was more an aspiration than a reality, Thomas had at the age of 26 married Anne Ferneley, widow of the mercer William Reade, who had two young sons by her first marriage. The Reades were already closely associated with the Greshams because Thomas's father, Sir Richard, was a trustee of Reade's will. As was common at this time, Anne remarried very quickly after the death of her first husband. For a young man like Thomas Gresham this wealthy woman must have been a very attractive bride, for after their marriage he not only managed the estates which were held in trust for her sons but also amalgamated her late husband's business with his own and took over Reade's apprentices and factors. When in 1546 Thomas took over the *de jure* headship of the Netherlands operations of the 'House of Gresham' the couple had been married eighteen months and had recently moved into a rented house in

¹¹ *SPF*, 22 June 1560.

¹² The data from Gresham's Day Book entered on an Ingres database system has been utilized for an analysis of his domestic arrangements in J. Newman, 'Thomas Gresham: private person rather than public figure', *History Teaching Review. Year Book VII* (1993), pp. 13–22.

Basinghall Street for the lease of which they paid £66 13s 4d. In July 1548 he bought a house from the Crown for £47 12s 0d. It had formerly been a chantry and is described as being in the parish of St Lawrence, opening opposite the Yeldhall Gate. During the years 1543-63, when he continued to combine the roles of merchant and royal agent, he was frequently absent from home travelling back and forth between London and Antwerp: in the space of a mere eighteen months between December 1551 and July 1553 he allegedly made as many as forty passages across the Channel. He also travelled to Norfolk and Suffolk to check on the management of the Reade estates and to visit Ringshall in Suffolk and Inwood Hall in Norfolk, where he regularly made his filial devotions until his father's death in 1549 and thereafter, having inherited these properties, entertained the Gresham clan.

The domestic arrangements over which his wife, Anne, presided were thus complex in structure and heavily influenced by the exigencies of her husband's business career. In the years to 1548 the Basinghall Street household could consist of her husband, her young son William, Thomas Bradshaw, her husband's apprentice, and John Elliot, his factor, as well as personal and household servants, and from 1547 Edmond Hogan and William Bindlosse who joined her husband's employ in that year. Anne's elder son, Richard, was away from home at this time, boarding with Ralph Ratcliffe who was paid £10 a year for his tuition and keep. He came to London on visits from time to time but there is no indication that he enjoyed regular holidays with his mother or step-father. In 1546 Anne became pregnant and, with her husband away, her father, William Ferneley, took up temporary residence at Basinghall Street. She gave birth in March 1547 to the only live child the couple seem to have had - their son, Richard. The birth seems not to have been an easy one, for three separate payments were made in that month to different physicians. A nurse was found for the little boy and in May his father provided three yards of silk saye to be made up as clothing for him. Thanks to the generosity of Thomas's father-in-law, William Ferneley, the Basinghall Street house in which this group resided was well furnished. During his temporary stay there in 1546 he had not only paid that year's rent for the property but had also bought a long list of furniture which was required for the new house.

Household expenses amounted to between £150 and £175 a year in which was included most of the food consumed, small purchases, and servants' wages. Some food, moreover, was not included in Anne's household budget: for instance, meat was bought from William Delason, the butcher, and the bill, about £30 a year, was paid from the business accounts. Some special foodstuffs were also bought or imported by Gresham for the household. A few household items were also bought in London or Antwerp, such as andirons for the fireplace, a mirror, nails, feathers and knives; and occasionally supplies arrived from the Reade estates - poultry, candles and

firewood - for which the cost of carriage was charged to the business. Besides housing and feeding their dependants, the Greshams also clothed them. A variety of cloths were taken from the stock in the shop to be made into clothes. The cloths from the shop were made up for the household by a tailor, hosier or capper depending on the garments concerned, and the services of an embroiderer were also required on occasion. Shoes and boots were bought from the shoemaker, who also repaired shoes.

Other details of the life style enjoyed by Thomas and Anne Gresham are somewhat sketchy but a few fine details can be added to the picture. The type of amusements in which the family indulged can be delineated. They appear to have had minstrels to play at the Christmas period of 1547 and Thomas at least attended the celebrations when his uncle, John, became Lord Mayor in 1547. The pastime in which Thomas most frequently indulged was gaming, usually playing dice, but on occasion a game called bank notes, and advances of money for this purpose and the settling of debts are noted fairly frequently in his accounts. Whether his wife was similarly addicted to games of chance cannot be adduced but her expenses show that her most frequent entertainment was attending the christenings of her friends' children.

Apart from being the head of a large household, Thomas Gresham was also a member of a prosperous extended family all of whom seem to have been mutually supportive. Many of his relatives were supplied with cloth and imported wares. Some took the form of sales but others were gifts, perhaps for special occasions or just out of affection. When his sister, Christiana, married Sir John Thynne in 1548 he gave her a gold ring set with a ruby and valued at £13 6s 8d. He supplied the Thynnes with a wide range of cloths and household goods such as coverlets, andirons and silver plate in the form of eight bowls and a basin and ewer. Thynne apparently had expensive tastes as the items mentioned above cost him £35 3s 6d and £24 18s 9d respectively, and on another occasion he bought a diamond for the large sum of £25. Gresham's step-mother, Isabelle, and sister, Elizabeth, received presents of cloth as did his brother John, sister-in-law Frances and their daughter Elizabeth - usually velvet or damask in varying lengths - and he frequently imported wine and sturgeon for his uncle, Sir John, and for his father, Sir Richard. The picture which emerges is of a close-knit family who worked together for the benefit of all. Also included in this family network were his wife's relations. William Ferneley frequently received payments from his son-in-law and, on his side, acted for Gresham when he was abroad. Anne's sister, Jane, married Nicholas Bacon, the Lord Keeper, thus providing Gresham with another patron at court, and the usual gifts of cloth were made to this couple. The relationship was later reinforced when Gresham's illegitimate daughter, Anne, married Nathaniel Bacon, the son of Nicholas and Jane.

Thomas and Anne Gresham thus enjoyed a comfortable style of life. This large household and extended family network, moreover, remained at the core of their domestic arrangements. This was in spite of their frequent changes of address – Basinghall Street (1546–48), Cheapside (1548–51), Lombard Street (c.1553–c.63) in London and an unlocated property (1551–53) and house in the Lange Nieustrate in Antwerp (1559–67/74) – and in spite of the necessity of completely refurbishing their home when, as Thomas explained, ‘my plate, household stuff and apparel of myself and my wife (which I sent and prepared unto Antwerp to serve me during my service there) by casualty of the weather coming from Antwerp’ in July 1553 were ‘all lost’.¹³ During the years 1544–63 Anne’s domestic responsibilities underwent a process of extension rather than transformation. In addition to her duties at her husband’s metropolitan residences she also became in the course of time mistress of Inwood Hall in Norfolk which Thomas had inherited from his father in 1549. Here with their children, Richard and Thomas’s illegitimate daughter Anne, the couple entertained the Gresham clan and such royal officials as were in the neighbourhood. From here Thomas was also able to undertake the supervision of the administration of a rapidly growing country estate in Norfolk. In 1553 he acquired Walsingham and Westacre Priors, valued at about £260 and £150 per annum respectively. To these were added in 1556 the priory of Austin Canons at Massingham with the manor and rectory at Langham and advowson of the vicarage; the manors of Walsingham and Narford, besides those of Merston and Combes, and the advowson of their respective rectories which he later declared yielded him an annual income of £200.

Whilst life continued much as before at his London and Antwerp residences during the years 1544–63, therefore, Thomas also from 1549 on occasion retired with his family to Inwood House. When present there he continued, moreover, in the now somewhat old-fashioned ‘hospitality’ which had characterized life at the Hall during his father’s lifetime. The income to support this ‘hospitality’ at Inwood Hall and the maintainance of the property at Ringshall, which he also inherited from his father (and used at this time when forced to stop over at Ipswich in the course of his duties as merchant-Crown agent) now, however, increasingly derived from revenues from his Norfolk estates and the rewards for his service as Royal Agent in the Netherlands, rather than from the profits of his trading and exchange operations.

THE MOVE TO GRESHAM HOUSE

The years 1559–64 marked the high point of this career as a servant of the Crown. Thomas was knighted in the summer of 1559, preparatory to taking

¹³ BL. Cott. MS Ortho E x, f.43.

up a temporary appointment as ambassador to the court of the Duchess of Parma, Regent of the Netherlands, and his career thereafter went from strength to strength. In his capacity as Royal Agent in the Netherlands, having all but eliminated the English Crown's debts to the Antwerp financiers,¹⁴ he stood high in Elizabeth's esteem and was increasingly involved by her in such wide-ranging schemes as the recoinage of 1560 or the reform of the London customs house in 1561-62. His successes in public office, moreover, brought with them public reward and, much to the delight of his social-climbing wife Anne, a complete change in life-style. This involved him in acquiring new residences which would allow him to effect a separation between his domestic-public life and his mercantile-financial activities.

New country houses, convenient to London, were bought at Mayfield in Sussex and Osterley in Middlesex whose opulence may perhaps be gauged by the valuation of the former property's furnishings at some £7,550. In London he similarly transformed his modest house in Lombard Street into business premises and took up occupancy in the grandiose Gresham House which he built a few years before 1566 in Bishopsgate and furnished at a cost of some £1,128. Whether at his London residence, Gresham House, or his country properties he dispensed, moreover, a lavish hospitality, of which all classes were glad to take advantage. Public recognition and esteem were also coupled at this time with domestic contentment. He enjoyed close relations with his wife, who revelled in her role as mistress of his opulent household, and when in London the couple enjoyed the company of their now adult children and step-children, as well as the companionship of Gresham's cousins Noel and Cecily, the latter with her husband German Coill then occupying the neighbouring Crosby Hall before Coill's bankruptcy in 1566. Looking back, Gresham must have later remembered these as the 'good' years.

Certainly from 1563 life was never to be the same again. Plagued since 1560 with a mis-set broken leg, the result of a riding accident, he steadily deteriorated in health thereafter, in spite of the efforts of the surgeons. In 1572, at the relatively young age of 54, he declared himself to be both 'blynde and lame'. Far more significant in shaping his later life, however, was the psychological trauma occasioned by the death in 1563 of his only son, Richard. As in the case of his own father, some forty years earlier, domestic tragedy made Thomas only too aware of the fragility of familial happiness and public esteem and caused him to review his life. With his link to immortality through his son suddenly severed, he almost immediately set

¹⁴ O. De Smedt, *De Engelse natie te Antwerpen in de XVIe eeuw (1496-1582)*, 2 vols (Antwerp, 1950-54), I, p. 329 and II, p. 558.

¹⁵ C.E. Challis, *The Tudor coinage* (Manchester, 1978), pp. 120-21.

about recreating it – in stone. On 4 January 1565 he accordingly took the first step in this process of immortalization by proposing to the Court of Aldermen of the City that a bourse or exchange should be built in London at his expense for the accommodation of merchants, thereby beginning a project which was to occupy both Sir Thomas and his factor and friend Richard Clough fully for some three years.¹⁶ Even before the final touches were put to the edifice in December 1568 and commercial success was ensured by Elizabeth's visit thereto in January 1571, however, the daemon which drove him ensured that he would continue in his new role as public benefactor. Thus were built the eight almshouses behind his mansion in Bishopsgate. It was probably also at about this time that he first conceived the idea of making an educational endowment, his first choice of recipient apparently being his old university of Cambridge. When it came to making the necessary dispositions in 1575, however, it was not Cambridge that benefited. He ordained that Lady Gresham should enjoy his Bishopsgate house, as well as the rents from the Royal Exchange, during her lifetime, but that thereafter they would be vested in the hands of the corporation of London and the Mercers' Company who would conjointly nominate seven professors to lecture there successively, one on each day of the week, on the seven sciences. Following the death of his widow in November 1596, Gresham College was born: the first professors occupied their chambers in the Bishopsgate property during March 1597 and lectures commenced the Trinity term following. Whether in 'good' times (1559–64) or more 'difficult' ones (1564–79), therefore, Sir Thomas's domestic and public life was played out from one or other of his new residences, including Gresham House.

It was from these residences, moreover, that during the years 1559–75 he conducted his still varied business ventures: arranging loans for the Queen on both the London and the combined Antwerp–Frankfurt finance markets, purchasing and surreptitiously shipping 'harness' for the Crown, organizing the gathering of political intelligence in the Netherlands, and deploying his mercantile contacts to satisfy his own and his patrons' material desires. But the day-to-day management of these affairs was increasingly left to others. The indicated sources of Gresham's business correspondence suggest that more and more he absented himself from attendance at the Lombard Street business premises of the 'House of Gresham' and, having paid off the Crown's debts to the Antwerp financiers, he was able to sell the Company's house in the Lange Nieustrate at some time in the period 1567–74. Business contin-

¹⁶ On the labyrinthine negotiations concerning the acquisition of a site for the Exchange see J. Imray, 'The Origins of the Royal Exchange', in Ann Saunders (ed.), *The Royal Exchange. Essays on the history and topography of a London institution*, London Topographical Society 152 (London, 1997), pp. 20–35, and for a full description of the building of the Exchange see Ann Saunders' contribution *ibid.*

ued as usual. Now, however, Richard Candeler (until 1566) and thereafter William Fayre handled everyday matters in London, making irregular attendances at Gresham House to receive instructions from their master. Similarly when again in 1575 the Crown evinced an interest in raising money on continental finance markets, Gresham delegated the task of negotiating the loan with the Frankfurt financiers to his erstwhile Spanish factor, Edmond Hogan.

That integration of domestic-public life and mercantile-financial activities which from around 1543-64 had characterized Thomas Gresham's domestic arrangements thereafter disappeared. Until a few years before his death in 1579 business continued as usual at the Lange Nieustrate and Lombard Street offices of the 'House of Gresham', but Thomas would rarely be found there. He now spent the closing years of his life either managing those country estates which subsequently were to pass to the collateral branches of the Gresham family line or organizing from Gresham House that self-glorificatory programme of public benefaction which led to the creation of the Royal Exchange and Gresham College.

Citizen and mercer: Sir Thomas Gresham and the social and political world of the city of London

Vanessa Harding

INTRODUCTION

Sir Thomas Gresham is remembered as a Londoner, and indeed as one of London's most prominent and celebrated benefactors, but he occupied in fact a somewhat anomalous position, born into and surrounded by the civic culture of London society but never fully integrated into the world of public service and civic office which was one of the chief characteristics of that society. London's population in this period was extremely fluid, physically and socially mobile, and experiencing rapid change and turnover. By contrast, the rulers of London had a strikingly cohesive identity, bonded by shared experience, sociability, and sense of collective responsibility. In many ways Sir Thomas Gresham reflected the London of which he was a native, but in other respects he was exceptional. By drawing attention to these characters of London society and of Gresham's life and experience, we can reach a better appreciation of his individuality.

MID-TUDOR LONDON: POPULATION SIZE AND STRUCTURE

The middle of Gresham's lifetime is, as it happens, one of the rare moments for which we can make a fairly confident estimate of the size of London's population. London as a whole had between 70,000 and 80,000 inhabitants in 1550, of whom about three-quarters lived in the city itself, in the area from Temple Bar to Whitechapel, and not more than a quarter in Southwark, Westminster, and the suburban fringes. 'London' was still very clearly identified with the physical form of the medieval city: city, suburbs, and satellites had not yet merged into the sprawling conurbation of the seventeenth century. This mid-sixteenth century snapshot of population size represents however only one moment in a long trajectory of growth: London's inhabitants increased over the sixteenth century from around 50,000 at the beginning to perhaps 200,000 at the end, and went on to top half a million by 1700.¹

¹ V. Harding, 'The population of early modern London: a review of the published evidence', *London Journal* 15 (1990), pp. 111-28.

London's growth, like that of all urban centres in this period, was fuelled not by the local birthrate but by massive migration flows from the countryside into the city. There was probably comparatively little growth, certainly in the city centre, for the first twenty or thirty years of the century, but there must have been a major flood of migrants into London in the 1530s, 40s and 50s, corresponding to the increase in national population. These flows obviously continued in the later sixteenth and seventeenth century: to maintain the observed rate of growth, there must have been a net inflow of 3-4,000 migrants a year by 1600. The capital drew its population from all over England. Less than 20 per cent of new freemen in the early 1550s were London born; another 30 per cent came from the southeast and the eastern counties; slightly over 20 per cent came from the midlands and the west, between 80 and 150 miles; and another 30 per cent from the north, from more than 150 miles away.² A further factor was the arrival of Dutch- and French-speaking Protestants from the Netherlands following the breakdown of religious toleration and stability there in the 1560s: the alien population of London may have doubled in a decade, reaching 4-5,000 by 1570.³

Contemporaries were very conscious of the flow of migrants to London, though they do not appear to have been seriously anxious about the implications of such growth until the 1570s, when the downturn in overseas trade had begun to affect prosperity and employment in the clothmaking and finishing industries. From the early 1570s, there appear in the records complaints and petitions against practices and individuals contributing to perceived economic and social problems. The 1571 petition of the Londoners against alien merchants and craftsmen is one example. The Vagabonds Act of 1572 was a national response; on a local scale, there is the increased activity of London's Bridewell, which examined and punished, or sent back to their place of origin, some seventy people a year in the 1560s, but over 200 a year in the 1570s, and over 500 a year by 1600. Central government began to issue proclamations against the spread of London, whether through building in the suburbs or subdivision and multi-occupancy in the centre, from 1580.⁴

Tudor London's population, then, included a large number of recent provincial and continental migrants. It was also characterized by significant age and gender imbalances, because of the predominance of apprentices

² S. Rappaport, *Worlds within worlds: structures of life in sixteenth-century London* (Cambridge, 1989), pp. 78-9.

³ I. Scouloudi, 'Alien immigration into and alien communities in London, 1558-1640', *Proceedings of the Huguenot Society* 16 (1937-41), pp. 27-49.

⁴ I. W. Archer, *The pursuit of stability: social relations in Elizabethan London* (Cambridge, 1991), ch. 5; A. L. Beier, 'Social problems in Elizabethan London', *Journal of Interdisciplinary History* 9 (1978), pp. 203-21.

among all migrants. Apprenticeship was the principal way to obtain the economic and social privileges of London citizenship, which conferred rights of trade and numerous protections and opportunities. Following an opening-up of the freedom in the 1530s, probably some 75 per cent of adult male Londoners were citizens; those that were not either practised crafts and trades illegally, or worked in casual and unskilled labouring and without security. In the 1550s the majority of all migrants to London were seeking apprenticeships, and apprentices formed perhaps 10 per cent of the population. There was therefore a high proportion of young, unmarried, and recently arrived men in London: apprenticeship and apprentice culture were an important aspect of Tudor London society.⁵ The flow of young migrants may have contributed to the fluidity of London's population in another way, by increasing its already high mortality rate. Migration both increased the pool of diseases and exposed unseasoned individuals to endemic urban diseases. Mortality rates in normal years were three or four times higher than they are today, and rose to 10 per cent or even 20 per cent in epidemics. London experienced a plague visitation in 1548, the national influenza epidemic of 1555-58, and a very severe local plague in 1563.⁶

The age and gender imbalance also meant that the city had a somewhat lower than natural proportion of married couples and young children; though marital fertility was high and families once formed could be very large, the effect of this was curtailed by very high infant and child mortality. It was much more common for people to die young, even in young adulthood; it was common for the young to lose parents and siblings, and for the adult to lose children and spouses. Remarriage was frequent, for men and for younger and wealthier widows; many households were made up of children of more than one marriage, as well as the servants and apprentices who came from outside. Kinship networks might be somewhat attenuated, but the links could nevertheless be very strong.⁷

THE GOVERNMENT OF MID-TUDOR LONDON

This expanding, complex, metropolis was still, however, a relatively harmonious and politically stable society. It was held together by a series of

⁵ Rappaport, *Worlds within worlds*, pp. 51 and 53.

⁶ R. Finlay, *Population and metropolis: the demography of London, 1580-1640* (Cambridge, 1981), chs 5-6; P. Slack, *The impact of plague in Tudor and Stuart England* (Oxford, 1985); I. Sutherland, 'When was the great Plague? Mortality in London, 1563-1665', in D.V. Glass and R. Revell (eds), *Population and social change* (London, 1972), pp. 287-320.

⁷ Finlay, *Population and metropolis*, chs 5 and 7; V. Brodsky, 'Widows in late Elizabethan London: remarriage, economic opportunity and family orientations', in L. Bonfield, R. Smith and K. Wrightson (eds), *The world we have gained* (Oxford, 1986), pp. 122-54.

overlapping structures of authority and allegiance: 'worlds within worlds'. The prevalence of apprenticeship, a combination of discipline, training, and socialization, certainly contributed to this, and patriarchal authority in the household was also important. Citizens participated in local government and community life through the parishes, wards, and companies to which they belonged; they were bound into a larger whole through the city-wide institutions of representative councils and aldermanic authority.

STRUCTURES OF GOVERNMENT⁸

London was ruled by a court or council of twenty-six aldermen, one of whom held the office of Lord Mayor for a year at a time and represented the city on all ceremonial occasions. The aldermen were recruited by the existing court rather than being popularly elected: a slate of names was presented by the local constituency when a vacancy occurred, from which the Court of Aldermen approved one name. Vacancies occurred irregularly, since the position of alderman was normally held for life, unless business failure or other disaster forced a premature resignation. Either before, or soon after, his election as alderman, a man would serve as one of the two sheriffs for London and Middlesex, an onerous but necessary office. After this, unless his career was cut short by death or resignation, he could expect to take his turn as Lord Mayor in some eight to twelve years from his election as alderman. Those aldermen who had already passed the mayoral chair formed an elite group within the court, inferior in precedence to the Lord Mayor for the time being, but distinguished by their seniority and the knighthood which normally accompanied mayoral service. They held the more prestigious and honorary offices within the city.

The mayor and aldermen wielded real power within London, as legislators and policy makers, as justices of the peace, as dispensers of patronage, as the court of appeal for lesser civic proceedings. The Crown had a constant role, intervening with orders, requests, and suggestions, but the city normally acted independently though with due deference. The city's means of coercive enforcement were limited, and in a rapidly changing and expanding city there were many vexing and intractable problems, but there was a high degree of compliance. There was (on the whole) respect for the office and the individual, and aldermanic authority was supported by other structures of social discipline.

The charges of office were considerable, especially the term as sheriff and as mayor, which entailed costly hospitality. The rewards included some

⁸ For this section see Rappaport, *Worlds within worlds*, chs 2 and 6; Archer, *The pursuit of stability*, ch. 2; V. Pearl, *London and the outbreak of the Puritan revolution* (Oxford, 1961), ch. 2; F.F. Foster, *The politics of stability, a portrait of the rulers in Elizabethan London* (London, 1977), chs 2-3.

exemptions and privileges, and access to the patronage of civic benefices and offices, but were mostly more intangible: distinction in dress and deference at ceremonial occasions; a position of honour in the city; high status in any social, political or religious gathering within the city; respect from courtiers and officers of national government. In a sense, office-holding was its own reward, in a society that venerated seniority and social position.

Below the Court of Aldermen came a much larger council, the Common Council, with over 200 members, an important forum in its own right, which gave consent to taxation and issues of major public import and, in an enlarged form, made or approved the appointment of sheriffs, mayors, civic bureaucrats and parliamentary representatives. Two of the city's four MPs were common councilmen; Common Council also contributed men to the permanent and *ad hoc* committees to whom civic administrative business was increasingly being delegated. Common councilmen were elected at the annual meetings of the city's twenty-six wards, and held the position for several years, if not for life, rather like the aldermen. For many of them, this was the highest office they held, but it was also a necessary step for those rising to aldermanic rank. In most cases there was a close correlation between active service on committees and in offices of responsibility, and subsequent promotion to the Court of Aldermen.

The jurisdictions of wards and parishes overlapped in function and geographically: the boundaries of the city's twenty-six wards and 113 parishes hardly coincided at all. Both drew on the same constituency to fill their unpaid offices, the class of respectable householders, inhabitants of ward and parish. Financial stability, settled residence, and good name were the criteria here, as well as a willingness to take on sometimes tedious business on behalf of the local community. The ward communities met once a year, and reviewed peacekeeping and the watch, distributed the tax burden, indicted infringements of economic and environmental regulation, and disciplined social and moral misdemeanours. The alderman or his deputy presided; local inhabitants made up juries and served as local officers such as beadle, constable and scavenger. The effectiveness of ward jurisdiction is not very clear, since few records survive from this period, but it appears that the ward meetings served a valuable function in the local community, emphasizing collective responsibility and the virtues of good neighbourliness.

The obligations laid on parishes were perhaps clearer. They included the maintenance of church services and the fabric and possessions of the church, in accordance with episcopal injunctions. Since the middle ages parishes had elected churchwardens to fulfil these tasks for them, and an administrative committee or vestry had usually emerged. They employed a clerk or sexton, and raised money, usually by rate, to pay him; repaired and cleaned the church; purchased service books, vestments and plate; kept

accounts and inventories. In the Reformation years the personal sympathies of churchwardens and vestrymen often determined the speed and thoroughness with which the parish adopted reformed or catholic doctrine and practice. A handful of leading local men participated in each parish, taking their turn in the lower offices and then as churchwardens and auditors; resident common councilmen would normally be members of the vestry, and if an alderman lived locally he might well preside over the auditing of accounts. The hierarchy of the local community was represented in the seating arrangements in church, a careful placing by seniority, social rank, officeholding, and contribution to local burdens.

GUILDS AND COMPANIES⁹

The guilds or companies of London - the livery companies - formed a separate but related network of sociability and social discipline. Every citizen was a member of a city company, of which there were more than sixty, though their size, character and prestige varied greatly. The largest companies, mostly those involved in clothworking in some way, might have over a thousand members, the smallest, specialist craft companies, a few dozen. The wealthiest and most prestigious were those whose membership included numerous merchants and traders and which through the generosity of past members had accumulated endowments and estates. Social and occupational homogeneity was greatest within the smaller craft companies; in others there might be an important divide between large-scale practitioners, entrepreneurs and employers, on the one hand, and small craftsmen on the other. If the entrepreneurs were merchants their range of activities might diverge widely from the nominal specialism of the company, and their interests certainly would.

All the city companies, however, to a lesser or greater degree, functioned as hierarchical and self-regulating societies, where individual and collective interests were negotiated. They were all based on a central body of freemen householders, most of whom would practise the craft or occupation to which the company was dedicated. They employed journeymen - who hoped one day to be householders - and trained apprentices - who hoped to become journeymen and householders in their turn. Increasingly, the body of householders was divided between a lower group, sometimes called the bachelors or yeomen, and a superior one, the liverymen. The distinction was made by wealth as well by seniority, usually through informal co-option, and was embodied in the wearing of a distinct livery on ceremonial

⁹ For this section see Rappaport, *Worlds within worlds*, chs 6-7; G. Unwin, *The Guilds and Companies of London* (London, 1908), chs 14-15; J.P. Ward, *Metropolitan communities. Trade guilds, identity, and change in early modern London* (Stanford, CA, 1997), chs 2-3.

occasions. Only those who became liverymen could expect to take office as one of the company's wardens or masters, and to join the influential company elite, mostly of former wardens, known as the Court of Assistants.

Effectively, the assistants were the aldermanry of the company, a permanent, self-recruiting body of senior individuals who through personal standing and officeholding had acquired a controlling position. The Court of Assistants made important policy decisions on behalf of the company, disciplined junior members and dispensed patronage, including the charitable relief of poor members; they also responded to the demands of civic and central government which found these well-organized bodies of citizens a valuable tool for implementing policy. The original aims of the guilds and companies had included fraternal support and economic regulation; even if the latter was waning in some companies, collective celebration, including commemorative dinners, remained an important function, and the social side of company membership must have been one of its most valued aspects. As with the formal institutions of local and civic government, the livery companies were dynamic societies, in which promotion through the hierarchy was the concomitant of seniority, service and personal standing. Individuals were expected to participate at all levels; their rewards were largely in the form of status and peer respect. Personal and family connections also played a part in social mobility within the company structure, since a wealthy or well-connected father could secure his son's apprenticeship to a liveryman, and this in turn promised useful patronage at a later date. The approval of existing assistants or liverymen was necessary for promotion to the livery, and strong backing could certainly hasten it. A judicious marriage to a companyman's daughter or widow could also open up connections and opportunities.

THE RULERS OF LONDON

The worlds of the companies and of civic government interconnected in a very important way. Every citizen belonged to a company, but the members of only a few companies monopolized high civic office. A dozen leading companies had emerged by the middle of the sixteenth century, and most sixteenth-century aldermen came from six or eight of these. Of the twenty-six aldermen in 1550, six were members of the Mercers' company, four were members of the Merchant Taylors, three were Grocers, three Haberdashers, three Skinners, two Clothworkers, two Fishmongers, one a Goldsmith, one a Draper, and one a Salter.¹⁰ In later years the proportion of Mercers went down, and some other companies gained more aldermen, but the range of companies from which they came remained very restricted.

¹⁰ A.B. Beaven, *The aldermen of the city of London*, 2 vols (London, 1908-13).

Members of the Common Council came from a wider range of companies, somewhat more representative of the retailing and manufacturing sectors of the city's economy, but the great twelve still predominated, especially among the more active and upwardly mobile Councilmen. The leading city companies must thus have served as an additional forum for strengthening contacts between members of the governing class and perhaps also for informal discussion of city business. Certainly the companies with aldermen among their members gave them a place of honour; the Mercers commonly referred to 'the Wardens, Aldermen, and Assistants' when describing their ruling group.

All these local and civic offices were vertically integrated in that there was a single *cursus honorum*: just as no one became Lord Mayor unless he was an alderman and had served as sheriff, so no-one became an alderman without having served his turn, at an appropriate stage of his life, in parish and ward office. Service in livery company office intercalated with local and civic office: most men who became aldermen would also have held company office, including that of Master, and it seems certain that all common councilmen were at least liverymen. The age at which a man held a particular office, and the number of lesser offices he held, were related to his promotion prospects: those who moved fastest were going furthest, and skipped some minor offices, but there was no separate fast track. This integration of lesser and greater office-holding and of the different spheres of social and collective activity has been identified as one of the key characteristics of early modern London society. Parentage and patronage may have helped individuals to rise further and faster, but they did not do so without experience of and contact with the lower ranks of civic government. The rulers of Elizabethan London – the men who filled the Court of Aldermen and played a leading role in Common Council, and who also governed the city companies – were at least aware of the circumstances and problems of those they ruled.¹¹

Several historians have also argued for a kind of 'rulers' ethic', a collective world-view and programme shared by the rulers. They certainly shared economic interests and background. As has been indicated, they belonged to a select handful of city companies, and in practice were mostly engaged in mercantile activity. A large number of them were members of the Merchant Adventurers' trading collective; in later years they were prominent investors in the Muscovy, Levant and East India companies. They were an elite of wealth: to qualify for aldermanic office a man had to be worth at least 2,000 marks (£1,333 sterling), but many were much wealthier. The Jacobean aldermen constituted 'a sample of London's richest citizens', 40

¹¹ Foster, *The politics of stability*, chs 6–7; Rappaport, *Worlds within worlds*, chs 6–8.

per cent of whom left fortunes of over £20,000.¹² Traditionally, commercial success and political position went together, and arguably only someone who had already established his fortune in business could afford the time and incidental expenses of high civic office.

They were mostly self-made men: there was no long-lived civic aristocracy, and like the majority of London citizens, over 70 per cent of the city's rulers were first-generation immigrants. Immigrants might exploit connections and patronage, especially those who were successful in obtaining apprenticeships with powerful men and in the most prestigious companies, but even so, extrapolating from a prosopographical study of the seventeenth-century aldermen,¹³ it is likely that more than half of the sixteenth-century aldermen were sons of provincial tradesmen and yeomen. They therefore owed their success in significant part to their own efforts and abilities, in business and in exploiting social connections and opportunities. In the early to mid-sixteenth century, it is true, engagement in cloth export as a merchant adventurer was a fairly certain route to prosperity, though the difficulties of the 1560s brought several leading Londoners close to disaster.

For the sons of London citizens making careers in the city, there was quite a strong correlation between the father's rank and the one his son attained. It was obviously easier to rise within the city if your father was a liveryman, councilman, or alderman, and a brother's success might influence your own. Although there was no long-lived civic oligarchy, several families produced two or more aldermen. Three of the twenty-six aldermen serving in 1580 were the sons of aldermen, and two had brothers who were or became aldermen. What cannot easily be established, however, is how many sons of aldermen – as Thomas Gresham was – sought and succeeded in civic careers. What was perhaps more significant was the extent to which the families of aldermen and leading common councilmen intermarried: the ruling class was bonded by alliances made between adults, rather than by lineage links. The daughters and widows of city rulers helped to forge connections of wealth and interest. On the Court of Aldermen in 1580, there were four pairs of brothers-in-law, and three pairs of fathers/sons-in-law. In fact, nine of the twenty-six aldermen had married women whose fathers were or had been aldermen; one had married an alderman's widow, and one an alderman's grand-daughter. The Gresham family, therefore, with two aldermen in one generation (Richard and John), and an alderman son-in-law in the next (Sir Thomas Rowe), was by no means unusual.¹⁴

¹² R.G. Lang, 'London's aldermen in business, 1600-1625', *Guildhall Miscellany* iii. 4 (April 1971), pp. 242-64; R.G. Lang, 'Social origins and social aspirations of Jacobean London merchants', *Economic History Review* 2nd ser., xxvii (1974), pp. 28-47.

¹³ Lang, 'Social origins and social aspirations', pp. 28-47.

¹⁴ Beaven, *Aldermen*, II, pp. 172-4.

As noted above, historians have detected a rulers' ethic, and have pointed to their commitment to local, company and civic service. Presumably therefore these rulers sufficiently valued the rewards of officeholding – notably status and esteem. This was perhaps reinforced by the medieval and early modern culture of benefaction, in which they also participated. Before the Reformation, Londoners bequeathed significant sums of money and real estate for pious uses: chantries, anniversary masses, the works of Christian mercy. Funerals were attended by dozens of poor people, receiving clothing and small doles in return for their prayers; local communities, whether parishes or companies, benefited from the residue of pious and charitable donations. With the Edwardian Reformation, explicitly intercessory bequests were condemned as superstitious, and a whole range of *post mortem* commemorative activity was terminated. Nevertheless Londoners continued to make substantial testamentary bequests, nominally for charitable uses but often incorporating a significant element of personal commemoration. Without engaging in the debate on whether the real value of benefactions increased after the Reformation, it is clear that it was on a lavish scale, and that certain objects were favoured – including education and what W.K. Jordan, the historian of London charities, called 'social rehabilitation and municipal betterment'. There may have been an element of competition in this conspicuous benefaction, though the rationale was always the benefit of the recipients and the common weal. The majority of London's rulers were not, by the 1570s, notably 'Puritan' in their sympathies, but their charity was often carefully directed at deserving or respectable targets. Schools, scholarships and almshouses were frequent objects of endowment, and the provincial origins of the greater part of London's wealthy ruling class are reflected in the geographical spread of their foundations. City companies both received and administered benefactions, and the sixteenth century saw the beginnings of their role as managers of dedicated charities.¹⁵

SIR THOMAS GRESHAM

Thomas Gresham came from this civic and mercantile background, and shared many of its social and demographic characteristics. He must also have been fully exposed to the value-system and attitudes of the ruling class, but it is less certain how far he internalized these.

CHARACTERISTICS¹⁶

He was one of the minority of London citizens to come from citizen stock, and he undoubtedly benefited from the web of relationships and patronage

¹⁵ W.K. Jordan, *The charities of London, 1480-1660* (London, 1960).

¹⁶ For biographical details, see GL MS 1112 (MS book of extracts from College of Arms

opportunities of his Gresham connections. His father was Sir Richard Gresham, Mercer, who became alderman in 1536 and was promoted to the mayoralty well before his time, at the King's wish. Although Thomas's mother died while he was young, he had a rather larger London-based family than most: his father survived till he was about 30, and his stepmother until 1565. Thomas's uncle, Sir John Gresham, was also a prominent figure in the city, alderman from 1540 and Lord Mayor in 1547-8, dying in 1556.

Thomas Gresham married a fellow-Mercer's widow, with two small children, in 1544; they had one son, Richard, who died aged about 16 in 1563. Gresham also had an illegitimate daughter, Anne, born to a Flemish woman. Anne was apparently acknowledged at the time, and made a good marriage to Sir Nathaniel Bacon, knight, of Stiffkey, Norfolk, second son of Sir Nicholas Bacon, Lord Keeper of the great seal, but neither she nor his wife's son was mentioned in Gresham's will.¹⁷ He does appear to have been close to his niece Elizabeth, wife of Sir Henry Nevill, knight, regarding her as his 'heir apparent' after his son Richard's death. She died at his house in London in 1573, but was buried in the country. Gresham left her children cash legacies in his will and the reversion of his country estates. He also mentioned three other 'cousins' in his will, whose exact relationship to him is not known, and left £100 to a young woman with the same surname as his wife. His household and servants are however as prominent in the will as more distant members of his family.

Gresham's career in Crown service, and his frequent absences in Antwerp, seem to have prevented him from playing the part in city politics that might have been expected of his background. He is said to have served as common councilman for the ward of Cheap, in 1543, but no details of his service are known; it seems unlikely that he held the post for long. He was once nominated for alderman, in 1556, but not elected: another alderman chose to move to the vacant ward.¹⁸ Gresham was not nominated for alderman again, which is unusual, since commonly a man nominated once would be nominated again, two or three times, until he secured election to the court. It is not known that he ever had to fine out of office, but the Queen wrote to the Court of Aldermen in 1563, concerning his discharge

registers concerning Gresham family); J.W. Burgon, *The life and times of Sir Thomas Gresham* (London, 1839); G.W.G. Leveson Gower, *Genealogy of the family of Gresham* (London, 1883); *Dictionary of National Biography*. For the trade connections of London in Gresham's time, see G.D. Ramsay, *The city of London in international politics at the accession of Elizabeth Tudor* (Manchester, 1975), and its sequel, *The Queen's merchants and the revolt of the Netherlands* (Manchester, 1986). The London Record Society intends to publish an edition of Gresham's letters, edited by the late G.D. Ramsay and Ian Blanchard.

¹⁷ Printed in Leveson Gower, *Genealogy of the family of Gresham*, pp. 80-5.

¹⁸ Beaven, *Aldermen I*, p. 139.

from city offices, and he may have sought her protection against further nomination, as other Crown servants did.

He was more active in the life of his company, the Mercers. He was apprenticed, probably in the mid-1530s, to his uncle, John Gresham, a Mercer, who became an alderman in 1540. Thomas was made free of the company in 1543 and joined the livery in 1544, a speedy promotion which the patronage of his father and uncle must have influenced. He may have served as one of the company's wardens in 1552, and was certainly a member of the Court of Assistants by 1563. He served two full terms as Master of the company, in 1569-70 and 1573-4; he was elected Master again in 1579, but died halfway through his term of office. He was clearly often absent in the 1550s and 1560s, but he appears in the records of the company at intervals, though rather as a petitioner for company patronage on behalf of his protégés (for leases, scholarships, and so on) than as an active participant in company responsibilities.

This was probably nevertheless the civic setting in which he commanded most status. His knighthood in 1559 must have contributed to this, it being unknown for any citizen other than a Lord Mayor to have such a distinction; when he was present at a company dinner and meeting in 1567, for example, though he held no office that year, he was nevertheless listed after the aldermen of the company and before the wardens and other assistants. As outgoing warden in 1574 he nominated his successor, which was customary, but the clerk referred to his 'preheminance', which was not. In 1568 he was regarded as one of the benefactors of the company, to be commemorated by a terracotta bust or image.¹⁹

Gresham's religious outlook is not clear. We cannot read much into his will, made as it was some four years before his death, and recent writing has in any case warned us to beware of characterizing religious outlook on the basis of will preambles. It contains the common formula about the certainty of death and the uncertainty of its hour; he bequeathed his soul to God, 'trusting by the merits only of Christ's passion and death to be saved', an unexceptionable phrasing that betrays neither doctrinaire Calvinism nor leanings towards Catholic practices. He seems to have played little part in the life of his parish (St Helen's, Bishopsgate), even though, certainly by the later 1570s, he was no longer a frequent traveller. He held no parish office, not even acting as auditor of the parish's accounts, something local dignitaries were often called on to do, and which his neighbour Alderman William Bonde did. During the period he lived there, St Helen's changed from a rather conservative congregation, in religious terms (keeping a roodloft and chalice for some years after their removal or conversion had been ordered),

¹⁹ Mercers' Hall: Mercers' Company, Acts of Court, III, 1560-95.

to one that voluntarily established a weekly lectureship and appointed a notably radical preacher, at a generous salary. Gresham subscribed 40s to the cost of the lecture, twice what his fellow-parishioners Alderman Bonde and Councilman William Byrd did. Almost the only other reference to him in the parish records is to his pew, evidently in a prominent position, as befitted his rank, if not his participation in the local community.²⁰

CONCLUSION

By the time he made his will in 1575, Sir Thomas Gresham was, it seems, in a curious position. He had been born into a close world of Mercers and aldermen, where kinship and company membership forged strong links. At least to begin with, he had fully accepted that world, entering the Mercers' Company through apprenticeship, joining the Merchant Adventurers, and marrying a Mercer's widow. Subsequently, however, and partly through his father's court connections, he made a number of career choices which separated him from the milieu in which his father and uncle had achieved the supreme rank. He did not embark on the traditional *cursus honorum*, and he seems to have eschewed participation in the local community, but he had perhaps never abandoned the mentality of the citizen, that regarded civic status as the highest honour.

Though he was enormously successful in his chosen way, he never joined London's most exclusive club, the Court of Aldermen. He was at an impressionable age, around 20, when his father was Lord Mayor, and about 30 when his uncle was. He must have witnessed many ceremonial occasions at which honour and place were reserved to the civic hierarchy; on other occasions in the city he would always have ranked below the knighted aldermen at least. He certainly had a place of high honour in his company, and that company was still the premier one, but in terms of achievement in the city, Mastership even of the Mercers' Company was not in itself outstanding.

However, although he acquired country estates and had gentry connections, he never seems to have adopted an alternative set of values, of the court or the gentry. He was much wealthier than his elder brother, another Sir John, so gentility for its own sake may not have appealed to him. Had he had surviving children, he might have devoted his attention and resources to establishing a prosperous dynasty with his name, but his son Richard died in 1564 and the niece whom he regarded as his heir died in 1573. Unlike many of his contemporaries, he had no provincial birthplace on which to lavish endowments commemorating his achievements: all his

²⁰ Guildhall Library, MS 6836 (St Helen's vestry minutes and churchwardens' accounts, 1565-1654).

temporal loyalties were focused on the city and on his company. He remained in London, and the last afternoon of his life (a Saturday) was spent at the Royal Exchange.

The fact that he died suddenly, without a chance to revise or elaborate on his four-year-old testament, means that we do not have his own deathbed views on funeral attendance and commemoration; though he did specify 200 poor men and women – an unusually large number – to attend his funeral, which is said to have cost £800. He also apparently commissioned his own sober but handsome altar-tomb. But he may well have been conscious that his own funeral would be less impressive than an alderman's, which the whole Court of Aldermen (including at least half a dozen knights), and the Lord Mayor and swordbearer would be expected to attend. As it was, though we are told that his corpse was 'in seemly sort ... accompanied to the grave with many worshipful and other his friends', the chief mourners were his nephew-in-law, Sir Henry Nevill, and four gentlemen or esquires, including Nathaniel Bacon, the husband of his natural daughter, and his business partner Edmund Hogan.

It is hard not to conclude that in his benefactions he was seeking to establish his name indelibly as a civic benefactor of the greatest munificence, in London. He may have had the model of Richard Whittington, the fifteenth-century Mercer-Mayor, in mind. The scale of all his bequests (charged on the revenues of the Royal Exchange, to which his perpetual title was debatable) was extremely lavish: his almsmen were to receive more generous pensions than most; his bequest of £100 a year to the Mercers for four quarterly dinners would have financed a debauch. And Gresham College itself was – and is – a unique and impressive foundation. He was not necessarily conscious of the motivation I have attributed to him, but he does refer to 'our honesties fames and good reports in this transitory world' as well as to 'the profit of the common weal and relief of the careful and true poor'. He certainly succeeded in establishing his name permanently; even if 'the fame of Sir Thomas Gresham' is not quite what it once was, he was justified in his confidence that 'so good purpose in the common wealth no prince nor council in any age will deny or defeat ... I do mean the same to the common weal, and then they that default thereof shall be to the reproach and condemnation of the said corporations afore god.'²¹

²¹ Will, printed in Leveson Gower, *Genealogy of the family of Gresham*, pp. 80–85.

Failed transmission: Sir Thomas Gresham, reproduction, and the background to Gresham's professorship of physic¹

Margaret Pelling

There is a consensus that, if Gresham College flourished, it was before 1650, and the fruits were limited to mathematics, astronomy and possibly music.² The Gresham professors of physic, it is generally agreed, signally failed to make an impact on their own subject.³ As a result, historians have understandably concentrated either on aspects of Gresham College's role unrelated to medicine, or upon institutional developments later in the seventeenth century connected with the Royal Society.⁴ It is ironical, in view of this adverse verdict, that those with medical qualifications formed a large proportion of the professoriate in the early modern period, and that it was the professors of physic who spent longest in their posts and were most likely to be resident in the college. From its foundation to 1660, the physic chair had fewest incumbents (five); of fourteen elections to chairs other than the

¹ This is a revised version of a paper first given at the Society for Renaissance Studies conference in March 1997 commemorating the quatercentenary of the College. I would like to thank the audience on that occasion for their comments. I am also grateful to Michael Bevan, Penelope Gouk, Lauren Kassell, Anne Laurence and Penny Tucker for their help on various points.

² The most comprehensive recent study of Gresham College is I. R. Adamson, 'The foundation and early history of Gresham College, London 1596-1704', PhD, University of Cambridge (1975). See also his published articles, cited in note 4 below.

³ Ward might be presumed to have made out the best possible case for the medical professors, since he was prepared to defend physicians in another context: see the biographical excerpt from *British Chronicle*, 1766, pasted into a copy of J. Ward, *Lives of the professors of Gresham College* (London, 1740): Oxford, Bodleian Library, Gough Lond. 141.

⁴ F. R. Johnson, 'Gresham College: precursor of the Royal Society', *Journal of the History of Ideas* 1 (1940), pp. 413-38; C. Webster, *The Great Instauration: science, medicine and reform 1626-1660* (London, 1975), pp. 51-3, 221-3, App. VII and passim; I. R. Adamson, 'The Royal Society and Gresham College, 1660-1711', *Notes & Records Roy. Soc. Lond.* 33 (1978), pp. 1-21; I. R. Adamson, 'The administration of Gresham College and its fluctuating fortunes as a scientific institution in the seventeenth century', *History of Education* 9 (1980), pp. 13-26. Otherwise, Gresham has been admired mainly as a scheme equivalent to adult or postgraduate education for the middle class: see for example P. Allen, 'Medical education in 17th century England', *Journal of the History of Medicine* 1 (1946), pp. 115-43, esp. pp. 134-6.

physic chair between August 1638 and January 1659, six involved victories for physicians.⁵ However, any contribution made by these men to life in the capital in terms of medicine or medical practice remains elusive. This is somewhat frustrating. The interactive model which was envisaged for the Gresham lectures, in which the auditors could question the speakers and thus 'resolve their doubts', should have been particularly well suited to medicine in early modern London.⁶ There was already a shared base of knowledge between practitioners and lay people, and almost universal and urgent interest in the practicalities of medicine as a subject.⁷ Unfortunately, evidence of such interchanges in and around Gresham College appears to be lacking. Failure, as I hope to show, can be well worth analysing, but with the Gresham professorship of physic there is, to date, too little evidence of the nature of that failure.⁸

By way of compensation, many intriguing aspects present themselves about Sir Thomas Gresham's own life and background in relation to the idea of 'failed transmission'. This essay will therefore take up issues which largely precede the appointment of the Gresham professors. I will be looking at the London College of Physicians and its relationship to Gresham College, but largely with respect to the sixteenth rather than the seventeenth century, and in terms of the kinds of issues of status which I have raised in recent work elsewhere.⁹ The first of these recent essays deals with issues of gender and status; in the second, I extrapolate from the first to consider, perhaps rather speculatively, how such issues might have affected both the relationships of physicians within their families of origin, and how physicians

⁵ Adamson, 'Foundation and early history', pp. 149, 209. In the 1670s, the physic professor, Mapletoft, was one of only two still in residence: Adamson, 'Royal Society and Gresham College', p. 5.

⁶ Webster, *Great Instauration*, p. 549; Adamson, 'Administration of Gresham', pp. 19, 22, 23; Adamson, 'Foundation and early history', p. 45. It should be noted that the Caroline code at Oxford instituted in 1636 placed a similar obligation of 'kindness' to auditors on the Regius professor of physic: Allen, 'Medical education', p. 119.

⁷ See for example D. Evenden Nagy, *Popular medicine in seventeenth-century England* (Bowling Green, Ohio, 1988); M. Pelling, 'Knowledge common and acquired: the education of unlicensed medical practitioners in early modern London', in V. Nutton and R. Porter (eds), *The history of medical education in Britain* (Amsterdam, 1995), pp. 250-79; J. Henry, 'Doctors and healers: popular culture and the medical profession', in S. Pumfrey, P. Rossi and M. Slawinski (eds), *Science, culture and popular belief in Renaissance Europe* (Manchester, 1991), pp. 191-221.

⁸ For the evidence that exists, see Adamson, 'Administration of Gresham', pp. 17ff; idem, 'Foundation and early history', ch. V.

⁹ M. Pelling, 'Compromised by gender: the role of the male medical practitioner in early modern England', in H. Marland and M. Pelling (eds), *The task of healing: medicine, religion and gender in England and the Netherlands 1450-1800* (Rotterdam, 1996), pp. 101-33; M. Pelling, 'The women of the family? Speculations around early modern British physicians', *Social History of Medicine* 7 (1995), pp. 383-401.

themselves constructed their own families and the dynastic lines of succession which were so important to them but which so seldom seemed to be achievable in a direct line. In tackling these areas we are of course discussing the subtle interactions between attitudes and lived experience. A particular point here, which will arise later, is the issue of sexual reputation. This has recently, and for good reasons, been discussed more in relation to how *women* were defined by early modern society.¹⁰ While wanting to point to the ubiquity of sexual reference and metaphor in early modern sources, which relates to the position of men and women alike, I would also suggest that the vulnerability of male physicians to innuendo in terms of sexual honour is itself a reflection of their difficult position in gender terms. However, sexual reputation is also a status issue, to do with clientage and dependence upon those higher up the social scale. The difficulties faced by physicians were in many respects specific to their occupation, but there is overlap, in terms of social origin, aspirations, and position in relation to elite clients, between them and the combined role of merchant and royal servant for which Thomas Gresham is so well known.¹¹ Dynastic imperatives form a vital part of the common ground.

I want to use these points as background in considering Gresham's own experiences and intentions, giving consideration both to the personal and to the institutional as a reflection of the personal. I would argue that this approach is more than defensible in relation to a period which was explicitly anthropocentric and which still saw society in terms of bodily metaphors. What Gresham seems to represent, in other words, is another variation of the rich and much-explored relationship between production and reproduction.¹² I would resist reducing this to the apparently obvious dyad of sex and money, not just for the sake of academic seriousness, but because the 'sex and money' formula seems to me specifically to ignore the central issue, for Gresham as for so many others, of transmission and

¹⁰ See for example L. Gowing, *Domestic dangers: women, words and sex in early Modern London* (Oxford, 1996).

¹¹ See also Pelling, 'Knowledge common and acquired', pp. 253ff, 259ff. On the family backgrounds of London physicians, see W. Birken, 'The Fellows of the Royal College of Physicians of London, 1603-1643: a social study' PhD, University of North Carolina (1977). In his 'The social problem of the English physician in the early seventeenth century', *Medical History* 31 (1987), pp. 201-16, Birken stresses the 'middling' rather than gentry status of the majority of physicians, and its consequences. R. Grassby, *The business community of seventeenth-century England* (Cambridge, 1995), p. 166, places the Greshams as moving back and forth between town (business) and country (gentry). On the socio-economic background of mercers, see S. Rappaport, *Worlds within worlds: structures of life in sixteenth-century London* (Cambridge, 1989), pp. 304-11.

¹² See for example J. Goody, *Production and reproduction: a comparative study of the domestic domain* (Cambridge, 1976); M. O'Brien, *The politics of reproduction* (London, 1981); H. Bradley, *Men's work, women's work* (Cambridge, 1989).

continuity.¹³ This can be put in another way. Since Gresham's posthumous reputation, as Bindoff has pointed out, was so much a creation of nineteenth-century capitalism, it is perhaps allowable to bring to mind a keynote reference of that period: Dickens's novel *Dombey and Son*, which effectively explores the disastrous consequences of the drive for continuity of a dominant male of the commercial classes.¹⁴ Dickens of course privileges reproduction – affective reproduction, even in the female line – over production, though we enter the story when production, in the form of Dombey's success in business, is a *fait accompli*.¹⁵ Gresham, it could be said, may have died without learning the lesson that Dickens sought to teach.

As is indicated elsewhere in this volume, the direct evidence we have of Gresham's own intentions is minimal. The ordinances for the remit and conduct of each professor were drawn up by the Gresham Committee nearly two decades after his death.¹⁶ The founder's non-specific intentions continued to hold sway by default, in that the more detailed ordinances were rejected by the first professors.¹⁷ In the absence of any real leverage by the Gresham Committees, the guiding instrument continued to be Gresham's will, as made statutory by Act of Parliament in 1581.¹⁸ Even allowing for the degree of faith often reposed in corporate trustees like the City and the Mercers' Company, and the fact that Gresham had to calculate that there would be, as he intended, a delay until after the death of his wife,

¹³ This is appropriately represented by the interplay of sex and money in the badinage between a French courtesan and Thomas Gresham's scapegrace nephew John, in Thomas Heywood's play, *If you know not me you know nobody* (Pt II): see *Dramatic works of Thomas Heywood*, 6 vols (London, 1874) I, pp. 307ff.

¹⁴ S. T. Bindoff, *The fame of Sir Thomas Gresham*, Neale Lecture (London, 1973), pp. 6–8, who notes *inter alia* that in 1845 Gresham became the first Londoner to be commemorated in the City by a modern street name. As further illustrations see Maria Hackett, *A brief memoir of Sir Thomas Gresham* (London, 1833); Henry R. F. Bourne, *English merchants*, 2 vols (London, 1866) I, ch. 7, and his *Famous London merchants. A book for boys* (London, 1869), pp. 39–64.

¹⁵ Dickens' *Dealings with the firm of Dombey and Son* was published in 1847–48. Dombey's only son dies, partly as an effect of Dombey's ambitions, and he alienates his daughter, only becoming reconciled with her after the failure of his firm and of a second marriage.

¹⁶ Adamson, 'Foundation and early history', ch. II; Adamson suggests that some of the trustees may have known Gresham's mind with respect to the College (p. 42), but this remains an assumption.

¹⁷ Adamson, 'Foundation and early history', p. 49; for the ordinances see App. I; and idem, 'Administration of Gresham', p. 15, n. 11.

¹⁸ Adamson, 'Administration of Gresham', p. 15. 23 Eliz. cap. 5 (Private Bill), reprinted in Ward, *Lives of the professors*, App. VI, pp. 16–27. Gresham's two wills, the second of which dealt with the College, are printed in G.W.G. Leveson Gower, *Genealogy of the family of Gresham* (London, 1883), pp. 80–5; the second will is also reproduced in Ward, *Lives of the professors*, pp. 19ff.

he provided (as was noted at the time) remarkably little detail to guide his proposed foundation.

This fact throws into relief one of the few stipulations he did make, which is that the professors should not be married. As Charles Webster pointed out some time ago, this stipulation has been somewhat overlooked, and it remains something of a mystery.¹⁹ Gresham's Protestantism, and his avowed hostility to priests and popery – however expedient in its nature, and notwithstanding his period of service under Mary – might rather lead one to expect a pro-marriage bias, at least in institutional terms.²⁰ Here however we have to bring in the assumption that Gresham meant his very brief stipulation to be taken literally: he excludes the married, rather than specifying the never married, thus giving scope to the appointment of widowers (which was not then a term in common use).²¹ Older writers assumed either that Gresham was deferring to Elizabeth's prejudices against marriage, or that, in spite of Gresham's ultimate rebuff to the University of Cambridge, he meant to duplicate in London the collegiate, almost conventual life of the learned celibate fellows of his *alma mater*. Such an interpretation does of course give priority to Gresham's brief period at Cambridge, rather than his unspecified connection with the Inns of Court, or his thorough training and lifelong connection with the Mercers' Company. The corollary of this would be that Gresham also wished to give preference in the appointments to graduates of Oxford or Cambridge, the highly educated products of all-male institutions.²²

¹⁹ Webster, *Great Instauration*, pp. 52–3.

²⁰ Adamson, 'Foundation and early history', pp. 13–19, follows Macfarlane ([C. Macfarlane], *The life of Sir Thomas Gresham*, Knight's Weekly 28 [London, 1845]) in seeking to modify Burgon's image of Gresham as a convinced Protestant. On Gresham's religious position see also the essay by Vanessa Harding in this volume (pp. 24–37 at 35–6). Current historiography tends to limit the effects of the English Reformation on marriage, partly to dismantle the connection between Puritanism and more enlightened views: K. M. Davies, 'The sacred condition of equality – how original were Puritan doctrines of marriage?', *Social History* 12 (1977), pp. 563–80; E. J. Carlson, *Marriage and the English Reformation* (Oxford, 1994).

²¹ Gresham formulated the stipulation as: that none should be chosen to read a lecture 'so long as he shall be married', or suffered to read any lecture or receive a stipend 'after that he shall be married': Ward, *Lives of the professors*, p. 23. On widowers, see M. Pelling, 'Finding widowers: men without women in English towns before 1700', in S. Cavallo and L. Warner (eds), *Widowhood in medieval and early Modern Europe* (Longman, in press), and essays by Julia Crick and Lyndan Warner in the same volume.

²² See for example Macfarlane, *Life of Gresham*, p. 204; J. W. Burgon, *Life and times of Sir Thomas Gresham*, 2 vols (London, 1839) I, pp. 40, 44–5; J. Stow, *Survey of the Cities of London and Westminster*, ed. J. Strype, 2 vols (London, 1720) II, App. 2, pp. 18–19. The collegiate model was reinforced by the response of the Gresham Committee on the issue of married professors: Adamson, 'Foundation and early history', pp. 56–7. Gresham did propose in 1577 to found a college at Cambridge, but jointly with the Mercers' Company, which rejected the proposal: Adamson, 'Administration of Gresham', p. 15.

In making this provision about marriage, Gresham certainly gave a kind of factitious advantage to academically qualified physicians, who, partly because of the length of their university education and partly for more subtle cultural reasons, had a tendency to marry late if at all.²³ As already indicated, the medically qualified, as well as the medically educated, were well represented among the professors of astronomy, music, geometry, and rhetoric (but not divinity), as well as dominating the professorship of physic.²⁴ However, that Gresham saw his future college in Oxbridge terms seems to me somewhat unlikely, even though he seems to have excited expectations in Cambridge. In spite of his soaring social ambitions, and his comparative detachment from City politics, Gresham's allegiance to the Mercers was probably stronger than that he felt towards Cambridge.²⁵ The Mercers were somewhat above the norms of craft companies, but they nonetheless belonged to a context in which male adulthood and civic status were tied to the idea of mastership, marriage, and responsibility for a separate household.²⁶ Gresham's attitude to apprenticeship in the top-ranking mercantile companies suggests that he did not believe in abbreviating the fairly long periods normally served by such apprentices, who were by definition unmarried and not masters of their own households.²⁷ Gresham himself married promptly but appropriately, at the age of about 25, even though choosing a widow with children of her own. He (or his family) also appears to have given the occasion major symbolic value, marking it with a portrait and other tokens.²⁸ Thus he may have had in mind that the professors would

²³ Pelling, 'Women of the family', pp. 389ff.

²⁴ See in general Ward, *Lives of the professors*; *DNB*; Adamson, 'Foundation and early history', ch. III. Among the seventeenth-century incumbents, formal medical qualifications were possessed by one professor of astronomy (Pope), two professors of music (Clayton, Knight), one professor of rhetoric (Crowne), and four professors of geometry (Turner, Whistler, Dacres, Hooke). Those with less formal medical interests included another professor of astronomy (Murray), another professor of rhetoric (Gooderidge), a professor of law (Leonard), and a third professor of music (Petty).

²⁵ On Gresham and the Mercers' Company see the essay by Vanessa Harding in this volume (pp. 24-37 at 35).

²⁶ See C. Phythian-Adams, *Desolation of a city: Coventry and the urban crisis of the late Middle Ages* (Cambridge, 1979); Rappaport, *Worlds within worlds*, esp. pp. 322-9; I. Krausman Ben-Amos, *Adolescence and youth in early Modern England* (New Haven and London, 1994), ch. 9.

²⁷ Burgon, *Life and times* I, p. 47; F. R. Salter, *Sir Thomas Gresham* (London, 1925), p. 72n.

²⁸ Gresham was married in 1544 to Anne, daughter of William Ferneley of Suffolk, and widow of William Reade, also of Suffolk and a citizen and mercer of London, who had died early that same year. Gresham's father acted as overseer of Reade's will: Burgon, *Life and times* I, pp. 49-50; *DNB*, art. 'Sir Thomas Gresham'. The beautiful portrait, now in the possession of the Mercers' Company, shows Gresham alone; there was possibly also an elaborate ring, containing two tiny gold 'figures of loves' (Burgon, *Life and times* I, pp. 50-52); these are reinterpreted as figures of birth and death signifying *memento mori* by D. Scarisbrick, *Tudor and Jacobean*

mostly be young men, not yet burdened with full adult responsibilities, who would be able to devote their time wholly to their role in the College.

This is also suggested by the relatively generous level of the stipends, which would limit the justification for grubbing for other sources of income.²⁹ William Petty, the author of plans to reform Gresham but later to be an absentee Gresham professor of music, had considerations like this in mind when he specified unmarried men for posts in his proposed teaching hospital, part of the Nosocomium Academicum.³⁰ High levels of urban celibacy notwithstanding, this would also imply an intention that the professorships would turn over fairly rapidly, rather than being held by individuals for their lifetimes.³¹ For the most part, this is what actually occurred, although to the least extent with respect to the physic professors. The most mundane explanation is that Gresham wanted his professors to be resident and accessible – as did some municipal authorities, who provided tied housing for midwives and medical practitioners whom they wished to be available to treat the poor – and did not want the accommodation of his Bishopsgate house, even though it was very extensive, to be wasted on the families of the professors.³²

It is hardly possible, on the available evidence, to decide between these explanations, but Gresham's stipulation about marriage should be borne in mind, not least because it became a bone of contention almost immediately after the first appointments.³³ Matthew Gwinne, the first professor of physic,

jewellery (London, 1995), pp. 33, 93. Gresham administered the estates held in trust for his wife's two sons by her first marriage, and also combined William Reade's business with his own, taking over Reade's apprentices and factors: Ian Blanchard, *New DNB*, art. 'Sir Thomas Gresham' (forthcoming).

²⁹ In 1617 the professors claimed that the stipend, £50 per annum, had been a 'competent allowance' for a single man but was no longer adequate because of the 'alteration of the times': Adamson, 'Foundation and early history', p. 58.

³⁰ Webster, *Great Instauration*, p. 294; for Petty's plans of c.1649, see pp. 221–4, App. VII. See also Adamson, 'Foundation and early history', ch. VI. Petty became professor of music in 1650.

³¹ 'Urban celibacy' was both a contemporary preoccupation, and a difficult-to-measure feature of seventeenth-century demographic regimes: see J. R. Gillis, *For better, for worse. British marriages, 1600 to the present* (Oxford, 1988); P. Griffiths, J. Landers, M. Pelling, and R. Tyson, 'Population and disease, estrangement and belonging', in P. Clark (ed.), *The urban history of Britain, Vol. II: 1540–1840* (Cambridge, in press).

³² See for example M. Pelling, 'Healing the sick poor: social policy and disability in Norwich 1550–1640', *Medical History* 29 (1985), pp. 124, 127. It should be noted that the Gresham Committee ordinances, after reiterating Gresham's stipulation about the professors, specified that the College porter too should not keep a wife, young children, or any other woman in the house: Adamson, 'Foundation and early history', p. 53; see also Matthew Gwinne's argument on the basis of the breaking of this condition, p. 57. The professors were also restricted as to guests or lodgers: Stow, *Survey II*, App. 2, pp. 2–3.

³³ The different drafts of the Gresham Committee ordinances use the one formula, 'single and unmarried men', for the stipulation about marital status of the professors: Adamson, 'Foundation and early history', pp. 256, 272.

appealed against it around 1606 when he himself wished to marry. Gwinne's arguments included the assumption that marriage should not be barred (and was not, for all *public* readers in universities), and that the main exception to this was where, in an institution, the needs of young resident students would be jeopardized by the demands of a tutor's family. This of course did not apply to Gresham College, which had no students but only seven 'grave professors'. On the positive side, Gwinne interestingly argued that unmarried physicians were much less consulted or 'freely informed' of 'womens causes to their cure' than the married equivalent.³⁴ Gwinne failed to carry his point, and Gresham's stipulation remained in place. In 1641, a Scottish supporter of Charles I, Mungo Murray, was removed from his questionable tenure of the professorship of astronomy by invocation of the stipulation against marriage.³⁵ In the Commonwealth period Oliver Cromwell overruled the stipulation, admittedly in respect of a particular individual (Thomas Horton, professor of divinity), but also in the context of plans for reforming the College along with other educational institutions.³⁶ Subsequently, the marriage issue was part of the eighteenth-century controversy over the College's future.³⁷ These very different episodes do, of course, suggest that the issue of married professors could mean very different things according to context. Similarly, the criterion of celibacy could be met, but effectively exploited, as when in 1627 one member of the nepotistic Croke family married and vacated his rhetoric professorship, only to secure the post for his new (very young) brother-in-law. Sir Kenelm Digby seems to have been able to use the College as a retreat for two years following the death of his wife.³⁸

Regardless of whether Gresham's ideas about institutional forms like collegiate celibacy are seen as more ancient or more modern, the inclusion of a professor of physic in his list of seven hardly requires explana-

³⁴ Oxford, Bodleian Library, Tanner MS 80, f. 90 [n.d. but c.1606]; Adamson, 'Foundation and early history', pp. 56-8. Gwinne's argument raises the possibility that women were intended to be among the auditors of the Gresham professors, but it could merely mean that an unmarried professor of physic was to be seen as necessarily deficient in one area of knowledge. A little later (1614), the College of Physicians gave as its view that bachelors should not concern themselves with women's conditions: Pelling, 'Compromised by gender', p. 113.

³⁵ Adamson, 'Administration of Gresham', pp. 20-1.

³⁶ *Ibid.*, p. 22. Horton married eleven years after appointment. Having obtained a dispensation from the Council of State, Horton also managed to obtain one from Charles II (subsequently revoked): Adamson, 'Foundation and early history', pp. 91-3.

³⁷ One abuse identified in the 1670s was the presence in the College of families, as well as subtenants: Adamson, 'Royal Society and Gresham', p. 5. There was a flurry of Bills to refound the College in the early eighteenth century, before the Act of 1768, which both allowed professors to marry and led to the demolition of the Bishopsgate buildings (pp. 9ff).

³⁸ Adamson, 'Foundation and early history', pp. 83-5; *DNB*, art. 'Sir Kenelm Digby', p. 967; Adamson, 'Administration of Gresham', p. 20.

tion.³⁹ It would have been very surprising if physic had been left out of such an inclusive plan for London, a national capital almost out of physical control which possessed medical corporations but no university.⁴⁰ Whatever its vested interests, the London College of Physicians was a licensing body, not an educational institution, its public lectures being few and far between and aimed primarily at claiming the right to dominate the education of surgeons.⁴¹ However, it is worth looking at factors which, at the least, might have ensured the inclusion of physic as well as influencing Gresham in other ways.

First, some of Gresham's most intense experiences took place in the 1550s, a decade as notable for its epidemics as for its political and religious upheavals.⁴² One of Gresham's tasks as an overseas agent of the Crown was

³⁹ Of the seven liberal arts, Gresham's professors represented one from the trivium (rhetoric) and three from the quadrivium (geometry, astronomy, music). Gresham's set of seven was completed by the three traditional university faculties of theology, physic and law. See *ibid.*, pp. 27–30 for schemes of educational reform contemporary with Gresham's put forward by his relative by marriage, Sir Nicholas Bacon, by Sir Humphrey Gilbert, and by John Dee. F. R. Johnson adds for comparison the Society of Antiquaries (1572): 'Gresham College', esp. p. 423. The first two schemes differed from Dee's and Gresham's in relating primarily to the education for politics of young nobles and gentlemen outside the universities. Gresham and Dee, who was, like Gresham, the son of a London mercer, educated at Cambridge but about eight years Gresham's junior, and a freeman of the Mercers' Company, had connections through the Muscovy Company, Frobisher's voyage of 1575, and economic issues relating to exchange. Dee's educational proposals were based on the quadrivium and emphasized mathematics: P. French, *John Dee* (London, 1987), pp. 166–71, 180n. For Dee's involvement in medicine and alchemy, see C. Webster, 'Alchemical and Paracelsian medicine', in *idem* (ed.), *Health, medicine and mortality in the sixteenth century* (Cambridge, 1979), pp. 305ff, 321–2. Dee owned a copy of Gresham's tract on exchange, as well as medical books emphasizing the moderns: J. Roberts and A. G. Watson (eds), *John Dee's library catalogue* (London, 1990), pp. 28, 32, 35–6, 160. The alderman Sir Lionel Duckett, an associate of Gresham and an executor of his main will, was possibly one of Dee's patients: A. B. Beaven, *The aldermen of the city of London*, 2 vols (London, 1908–13), II, p. 37; W. H. Sherman, *John Dee: the politics of reading and writing in the English Renaissance* (Amherst, 1995), p. 98. The much younger astrologer and mathematician Edward Gresham (1565–1613), whose prophecies were linked with Dee's in 1603, was possibly a connection of Gresham's: *DNB (Missing Persons)*, art. 'Edward Gresham'.

⁴⁰ Cambridge's bid in 1575 for Gresham's College stressed 'healthiness of climate' as one of Cambridge's advantages over London: Adamson, 'Foundation and early history', p. 38; A. L. Beier and R. Finlay (eds), *London 1500–1700: the making of the metropolis* (London, 1986).

⁴¹ See R. S. Roberts, 'Medical education and the medical corporations', in F. N. L. Poynter (ed.), *The evolution of medical education in Britain* (London, 1966), pp. 69–88. Roberts nevertheless sees the College of Physicians as 'capturing' the Gresham lectures, in the sense of alienating the interests of progressive surgeons (p. 76).

⁴² See E. A. Wrigley and R. S. Schofield, *The population history of England 1541–1871* (London, 1981), p. 234; P. Slack, 'Social policy and the constraints of government, 1547–58', in J. Loach and R. Tittler (eds), *The mid-Tudor polity c. 1540–1560* (London, 1980), pp. 108–14; P. Slack, 'Mortality crises and epidemic disease in England 1485–1610', in Webster, *Health, medicine and mortality*, pp. 9–59; A. Dyer, 'The English sweating sickness of 1551: an epidemic anatomised', *Medical History* 41 (1997), pp. 361–83.

to report on the health of important individuals like Mary's husband. In 1558, he reported on Sir William Pickering as suffering from the new burning ague, which was seen as striking particularly at the elite, and also saw himself as having suffered from a bout of it at about the same time.⁴³ His uncle John, with whom he served his apprenticeship, had died of a 'malignant fever' in 1556, along with other eminent persons.⁴⁴ Gresham's father had died in 1549. The 1550s also saw the deaths of his unmarried sister, Elizabeth, and his uncle Thomas.⁴⁵

Secondly, there is Gresham's possible link with Dr John Caius, the refounder of both Gonville and Caius College in Cambridge, and of the London College of Physicians. Both men went to Gonville, and both had connections with the Netherlands in the 1550s. Burgon perhaps has put it most strongly: 'they were both of an age, from the same county, and had studied at the same College. They were kindred spirits, and must have been friends'.⁴⁶ There is a lot of supposition and wishful thinking in this; it ignores both the possibility of religious and temperamental differences, and an estimated nine years' difference in age. With respect to the later life of each, Caius was President of the London College of Physicians for the last time in 1572, but from around the mid-1560s he was out of London, devoting himself primarily to Cambridge and to the reform of its medical faculty. It is true, of course, that on the available evidence Gresham's schemes had far more points of contact with Cambridge than they did with the London Physicians, especially if we take Cambridge's word for it, and some influence by Caius cannot be ruled out. We should also recall that the thoroughly humanist Caius has some claim to be regarded as a modernizer, at least in his early life, and that he produced in the 1550s a short Galenic but practical-political tract on the sweating sickness, regarded as the first monograph in the English vernacular on a specific disease.⁴⁷

There is, naturally, no necessary link between a conviction of the personal and political importance of disease, which Gresham could hardly have escaped acquiring in the 1550s, and the setting up of public lectureships in physic, but the two are at least not inimical. Although well able to escape the threat of plague himself, Gresham, like many of his peers, had some experience of aspects of public administration connected with plague epi-

⁴³ *DNB*, art. 'Sir Thomas Gresham', p. 588; Burgon, *Life and times* I, pp. 199, 256.

⁴⁴ *DNB*, art. 'Sir Richard Gresham', p. 585; Burgon, *Life and times* I, p. 19.

⁴⁵ 'Pedigree of Sir Richard Gresham', *Miscellanea Genealogica et Heraldica*, n.s. IV (1884), pp. 255-6.

⁴⁶ Burgon, *Life and times* I, pp. 204-5. On Gresham's connection with Gonville, see J. Venn, *Early collegiate life* (Cambridge, 1913), pp. 53, 67-8; Adamson, 'Foundation and early history', pp. 13-14.

⁴⁷ V. Nutton, 'John Caius and the Linacre tradition', *Medical History* 23 (1979), p. 381.

demics.⁴⁸ Moreover, Gresham's father and uncle, both members of the Mercers' Company, belonged to a context of Tudor government which had good reason to see threats to the public health as a serious matter of state, both institutionally and personally. One expression of this was the foundation of the London College of Physicians itself, in 1518, under the aegis of the commoner Wolsey and at the prompting of the Thomas More circle, in particular the humanist physician Thomas Linacre.⁴⁹ Gresham's father Richard was one of Wolsey's most loyal adherents.⁵⁰ More's connections with the Mercers' Company are well known; Linacre, like Gresham, also nominated the Mercers as administrators of his schemes to establish reformed medical lectureships. Linacre's plans, which soon ran into difficulties, were directed at Oxford and Cambridge. Gresham attended a school, St Paul's, which was also a creation of the More circle and associated with the Mercers.⁵¹

Similarly a part of Gresham's inheritance was the evolution of institutions directly related to public health, and in particular the health of the poor. Gresham's father Richard had first benefited from the spoils of the Dissolution, a process which included the suppression of the hospital of St Thomas Acre for the benefit of the Mercers.⁵² He had then involved himself, as a civic dignitary in London, in the refoundation of the London hospitals in the 1530s and 1540s. In the latter context, Richard would have had some association with the surgeons Thomas Vicary and John Ayliffe, a fact which balances the apparent predominance of physicians. The petition of 1538 to Henry VIII in which Richard was involved stressed 'healing and curing' by physicians, surgeons and apothecaries who were to be dependent upon stipends. Gresham's uncle John was also a member of the aldermanic committee looking into hospital provision.⁵³ Older sources give John some role in the transfer of

⁴⁸ Macfarlane, *Life of Gresham*, pp. 125, 130, 168; Adamson, 'Foundation and early history', p. 29.

⁴⁹ See C. Webster, 'Thomas Linacre and the foundation of the College of Physicians', in F. R. Maddison, M. Pelling and C. Webster (eds), *Linacre studies: essays on the life and work of Thomas Linacre c. 1460-1524* (Oxford, 1977), pp. 198-222.

⁵⁰ *DNB*, art. 'Sir Richard Gresham'.

⁵¹ J. M. Fletcher, 'Linacre's lands and lectureships', in Maddison, Pelling and Webster, *Linacre studies*, pp. 130, 132, 137-9 and passim; J. Simon, *Education and society in Tudor England* (Cambridge, 1967), p. 96.

⁵² *DNB*, art. 'Sir Richard Gresham'. J. Watney, *Some account of the hospital of St Thomas of Acon* (London, 1892), pp. 68, 76, 107-8, 125-6, 139, 147. Gresham's uncle John was also involved (p. 128). Earlier negotiations with the hospital had incidentally involved both Wolsey, and a dispute with the widow of 'Edmund Reed of Norwich' over a bequest by Reed to the Mercers (pp. 89, 95).

⁵³ Slack, 'Social policy and constraints', pp. 109-10; Burgon, *Life and times I*, pp. 26-9; C. Daly, 'The hospitals of London: administration, refoundation, and benefaction, c.1500-1572', *D Phil*, University of Oxford (1994), pp. 70-1, 100n, 102, 135. Simon, *Education and society*, p. 284, states that John Gresham served as treasurer of St Bartholomew's: I have been unable to verify this.

Bethlem hospital to the City, but recent research does not verify this. John was Lord Mayor in 1547–48, just after the City gained governance of Bethlem.⁵⁴ John, like Richard, certainly left bequests to the London hospitals and prisons; so did Thomas.⁵⁵ John gave gowns to sixty poor men and forty poor women to follow his coffin at his funeral, which struck contemporaries by its magnificence; Thomas, perhaps as much in rivalry as emulation of his uncle, appointed one hundred poor men and one hundred poor women for his own very expensive funeral.⁵⁶ One of Thomas's aims for his estate was the relief of 'the careful and true poor'.⁵⁷ The fact that Gresham's college provided housing for eight almspeople tends to be lost sight of, although they were established in the Bishopsgate house first and continued there to the end.⁵⁸ Gresham never laid down that his professor of physic should have any role in treating his almspeople, but the possibility cannot be ruled out on the grounds of social distance between doctor and patients. Norwich paid stipends to academically qualified physicians and aldermanic apothecaries to treat the poor, and attached such responsibilities to its hospitals and almshouses.⁵⁹

This is perhaps the best point at which to consider the level of civic commitment in Gresham's proposals, in so far as this relates to medicine. As Vanessa Harding discusses elsewhere in this volume, Gresham did not follow his father and uncle along the civic *cursus honorum* ending in the mayoralty.⁶⁰ However he resembled them in adhering to the court almost at the expense of relations with his fellow merchants. His later life was dominated by his relations with the Crown and the Privy Council, and he aped the way of life of the nobility in as many as five houses situated outside London.⁶¹ In this, Gresham's trajectory was similar to that of the College of

⁵⁴ Macfarlane, *Life of Gresham*, p. 26; F. R. Salter, *Sir Thomas Gresham* (London, 1925), pp. 25–6; J. Andrews et al., *The history of Bethlem* (London and New York, 1997), pp. 59–61, 74; Beaven, *Aldermen I*, p. 18 and II, p. 30.

⁵⁵ Burgon, *Life and times I*, p. 20 and II, pp. 492–3.

⁵⁶ Stow, *Survey I*, pp. 258–9; Burgon, *Life and times II*, p. 472.

⁵⁷ Ward, *Lives of the professors*, p. 25.

⁵⁸ The almshouses were integral to Gresham's Bishopsgate mansion, completed before 1566: Burgon, *Life and times I*, p. 284; for a discussion of the ground plan of the Bishopsgate house see the essay by Ann Saunders in this volume (pp. 1–12 at 7–8). Gresham provided that after 50 years, during which he expected the corporations to obtain a licence in mortmain, his almspeople, like his college in part, were to be supported by the City: Ward, *Lives of the professors*, p. 22. On later intentions towards the almspeople see Stow, *Survey II*, App. 2, pp. 21–2; Burgon, *Life and times II*, p. 494; Macfarlane, *Life of Gresham*, pp. 239–40.

⁵⁹ See M. Pelling, *The common lot: sickness, medical occupations and the urban poor in early Modern England* (Harlow, 1998), pp. 86–8 and passim; M. Pelling and C. Webster, 'Medical practitioners', in Webster, *Health, medicine and mortality*, pp. 217–23.

⁶⁰ Gresham is seen as an exception in this: F. F. Foster, *The politics of stability: a portrait of the rulers of Elizabethan London* (London, 1977), p. 98n.

⁶¹ Burgon, *Life and times*, gives details of Gresham's residences. See also Ian Blanchard's article in this volume, pp. 13–23.

Physicians. By the later sixteenth century, the physic College, although situated within the City walls, had become detached from City life and the City companies, except for its confrontations with the Barber-Surgeons' Company and its highly ambivalent relations with first the Grocers and then the new Society of Apothecaries, over all of which it sought to establish a superior position.⁶² When plague threatened, the members of the College, like Gresham himself, removed in a hurry, following their elite patients to safer residences in the country.⁶³ Like Gresham, the College corresponded constantly with its main source of authority, the Crown and the Privy Council, even though, for the College, this relationship was also the source of many of its major difficulties. The Gresham Committee's ordinances of around 1600 referred to the need for a fully responsive professor of physic in terms of every man's concern for his own health:⁶⁴ members of the Privy Council more than exemplified this social reality of universal concern and autonomy in health matters, in constantly claiming the right to employ whatever kind of practitioner they pleased. Thus the physic College's authority was constantly being undermined at source. Nonetheless, the College is best described, like Gresham, as in a client relationship to the Crown.

One would expect, on this basis, some propinquity at least between Gresham's plans and the physic College, even if only through the royal physicians. Gresham admittedly had six other professorships to think about, if he did think about them, but the physic College was normally more than vigilant about its prerogatives. Unfortunately the College's records are very thin before 1581, so that one cannot argue convincingly from silence. It is however notable that there is no reference in the College's Annals to Gresham College following the death of Lady Gresham and during the negotiations over the first professorships; nor is there any reference at the time of the first few appointments to the professorship of physic. Gwinne was not a member of the College when appointed; Mounsell was never a member; Winston became a fellow a few months before appointment.⁶⁵ The only reference to Gresham I have found in the College Annals for the early seventeenth century is that cited by Clark, in which a proposal for public medical lectures in London by James Primrose was rejected by the College

⁶² On the London medical corporations, see Pelling and Webster, 'Medical practitioners', pp. 167ff and sources there cited.

⁶³ On what follows, see M. Pelling, *The strength of the opposition: the College of Physicians and irregular practitioners in early Modern London* (Macmillan, forthcoming).

⁶⁴ Ward, *Lives of the professors*, p. vii.

⁶⁵ On the professors of physic, see *ibid.*, and *DNB*. Cook notes for the later seventeenth century that Edward Tyson was harassed by the College even though he was Gresham professor (and FRS): H. Cook, *The decline of the old medical regime in Stuart London* (Ithaca and London, 1986), p. 241. On Mounsell's appointment, see Adamson, 'Foundation and early history' pp. 80-81.

on the grounds that the then Gresham professor, Winston, who was currently a Fellow of the physic College, had trouble attracting an audience to *his* lectures.⁶⁶ There is an apparent congruity between the Gresham ordinances and the physic College's statutes c. 1601-02 in that both appear to adopt the schema for medical knowledge elaborated by Jean Fernel; this is attributed by Clark to the influence of Matthew Gwinne.⁶⁷

In the context of Gresham's royalism I would like to glance briefly at one of the alleged portraits of Gresham by Antonius Mor. This portrait, which I have seen only as reproduced by Burgon, shows Gresham half-length, looking towards the observer, and holding up a roundish object in one hand. This gesture is fairly pointed: he is not simply holding the object as an accessory. Older sources suggest that this object is a pomander, perhaps an orange stuffed with odoriferous substances, of the type said to have been flourished by Wolsey to ward off infection and snub his political enemies.⁶⁸ Much as I would like to believe that Gresham would give such foreground to a preservative against disease, it seems to me far more likely that the object, if it is an orange, would be a symbolic reference to the house of Orange; or, as in later examples of Northern iconography, that it should have some connotation of fruitfulness, including human fruitfulness.⁶⁹ Of these two explanations, I would naturally for present purposes prefer the latter, although in principle of course the two need not be mutually exclusive. It is worth noting at this point that Gresham was involved in marriage questions not only for Elizabeth but also for Edward VI; he later gave the royal succession symbolic importance in terms of the images to be put up around the Royal Exchange.⁷⁰ Very speculatively, it is possible that John Dee and Gresham shared the involvement each of them had in the major issue of the health of Elizabeth in relation to her marriage and the succession. One of Dee's specialities was lineage and possibly also fertility.⁷¹ As already indicated, these were common preoccupations of the period; but Dee's powers were seen as exceptional.

The Exchange was one of the places where the Gresham lectures themselves were advertised to their intended audience.⁷² The renters, placed by

⁶⁶ G. Clark, *A history of the Royal College of Physicians of London*, 2 vols (Oxford, 1964-6) I, p. 257; London, Royal College of Physicians [CPL], Annals, 9 January 1630, p. 272 [page references are to the transcript/translation of the Annals, now available on microfilm].

⁶⁷ Clark, *History of the College of Physicians* I, pp. 170-1, 179.

⁶⁸ Burgon, *Life and times* I, pp. 207-8; I, App. XIX, pp. 481-3.

⁶⁹ For some of Gresham's personal contacts with the house of Orange, see *DNB*, art. 'Sir Thomas Gresham', pp. 590-1. A painting that plays on fruitfulness is Frans Hals' *Catharina Hooft with her nurse*, c.1619/20, in which the smiling infant, and the fruit held up by the nurse, both present themselves for the attention of the viewer.

⁷⁰ *DNB*, art. 'Sir Thomas Gresham', pp. 587, 588; Burgon, *Life and times* I, pp. 312-17 and II, pp. 217ff, 250ff; A. Saunders, *The Royal Exchange* (London, 1991), pp. 11, 16.

⁷¹ Roberts and Watson, *Dee's library*, pp. 27, 32; Sherman, *John Dee*, p. 247n, 175.

⁷² Adamson, 'Foundation and early history', p. 74n.

Gresham in the shops which formed part of the Exchange were described by Ward as 'of different trades, chiefly young men of small fortunes, but industrious'.⁷³ Among the first renters were apothecaries, barber-surgeons, and practitioners of physic.⁷⁴ Such shops were undoubtedly locations where interchanges of information took place, albeit without the structure of academic authority planned for Gresham College. It is perhaps ironical, in relation to the endeavours of both Gresham *and* the College of Physicians, that the Exchange also became a popular location for performances by medical empirics and for the posting of advertisements for medical remedies.⁷⁵ A similar, related contrast is provided by the playwright Thomas Heywood, described by Louis Wright as 'the greatest theatrical spokesman of the bourgeois ideals of his age'.⁷⁶ A number of Heywood's plays have the Exchange as a main point of reference. *If you know not me, you know nobody (Pt II)* (1604-05) celebrates Gresham as the mercantile backbone of English prosperity and national identity. Gresham's royalism is equally striking: he is shown as intensely loyal to his queen, and as at the same time making financial gestures exceeding the resources of lesser monarchs. Another play by Heywood, *The Wise Woman of Hogsdon* (c.1604), ostensibly denounces the wisewomen of London for swindling the credulous out of their hard-earned savings; in fact, the Wise Woman, although a practitioner of physic, dominates the play as a successful matchmaker.

What do we know of Gresham's relations with his own medical attendants? Many early modern examples of the patient-practitioner relationship bear out the traditional grievance of physicians, that the relationship broke down as soon as the patient felt close to recovery.⁷⁷ However, relationships between an early modern physician and his patients could be close and conversational even if they were not equal. In this regard medicine is in a peculiar position with respect to the means of personal influence.⁷⁸ It is

⁷³ Ward, *Lives of the professors*, p. 12.

⁷⁴ Saunders, *Royal Exchange*, p. 12, quoting Stow (apothecaries). The Gresham Repertories at Mercers' Hall name as renters in the 1590s and 1600s barber-surgeons (male and female) and barbers, one of them poor. A 'doctor of physic' also had a shop there: Professor Denis Hill, personal communication. I am grateful to Professor Hill for this information. In general see A. Saunders, 'The organisation of the Exchange', in idem (ed.), *The Royal Exchange*, London Topographical Society 152 (London, 1997), pp. 85-98.

⁷⁵ Actual instances are recorded in CPL, Annals; see also M. Pelling, 'Appearance and reality: barber-surgeons, the body and disease', in Beier and Finlay, *London 1500-1700*, pp. 85-6. A later writer (Steele) describes the Exchange as haunted not only by fruitwomen but by 'mumpers, the halt, the blind and the lame': Burgon, *Life and times II*, p. 514.

⁷⁶ L. B. Wright, *Middle-class culture in Elizabethan England* (Ithaca, NY, 1935), p. 650.

⁷⁷ A contemporary pictorial representation is the series by Hendrik Goltzius, in which the physician begins as god, and ends as devil: C. Zigrosser, *Ars Medica*, ed. D. R. Karp, Philadelphia Museum of Art (Philadelphia, 1985), 30a-d.

⁷⁸ For some discussion, see Pelling, 'Compromised by gender'.

therefore worth looking at what is known of illness episodes in Gresham's own life, besides the attack of ague already mentioned. In later life Gresham, like so many others of his time in the hierarchy of power, pleaded old age, blindness, gout and general infirmity in fending off orders or requests. Gresham lived until the age of 62 and died suddenly, possibly of a stroke affecting his speech. His main health problem throughout life was, however, surgical rather than medical. His leg was broken, possibly crushed, as a result of a fall from his horse in 1560, when he was aged around 40, and Gresham described himself as lame thereafter.⁷⁹ He had a surgeon called Dirricke in attendance in 1572, and refers then to his unhealed leg throwing up pieces of bone.⁸⁰ In the more personal of his two wills, dated 4 July 1575, he left annuities of £2 to three practitioners, Mr Dr Lankton, Dr Jefford, and Rauf Morrys, and £5 to a fourth, William Gotherns, 'for their counsell and help in phesick and surgery'. This formulation leaves open the possibility that Gresham might have taken his legatees' advice on more than clinical matters, although the larger legacy to Gotherns suggests Gresham had his surgical condition in mind. Gotherns is possibly William Gossen, a London barber-surgeon who died around 1591; or, more attractively, the well-known surgeon William Gooderus, whose name is variously spelt, later sergeant-surgeon to both Elizabeth and James. Gooderus went as a surgeon in the military expedition to the Netherlands in 1585-6, and was one of the surgeons remembered in the will of Sir Philip Sidney.⁸¹ The only Raphe Morris I have found so far is an apothecary and grocer who was based in the London parish of St Stephen's, Walbrook between 1568 and 1607.⁸² No identification can be made, but in principle it is possible that this apothecary practised physic.

The others can be more confidently identified. Dr Jefford is probably Roger Gifford or Giffard, an Oxford-trained physician and Linacre lecturer there, President of the College of Physicians by 1581, and physician to Elizabeth; he died in 1597. Gifford bequeathed an up-to-date medical library,

⁷⁹ Bindoff, *Fame of Gresham*, pp. 16-17; Burgon, *Life and times* I, p. 368 and II, pp. 423, 471; *DNB*, art. 'Sir Thomas Gresham', p. 586.

⁸⁰ Burgon, *Life and times* II, pp. 423-4. Gresham writes to Burghley of returning Dirricke home from Mayfield, Sussex, one of Gresham's estates. I have been unable as yet to identify Dirricke. The only person bearing something like this rather unusual name in Gresham's approximate circle is John Derricke, follower of the Sidney family and author of *The image of Ireland* (1581).

⁸¹ William Gossen's will was proved in the PCC, 1591 (93 Sainberbe). For Gooderus, who died c.1613 (will PCC 1613, 120 Capell), see S. Young, *Annals of the barber-surgeons of London* (London, 1890), p. 18 and passim; R. H. Jeffers, *The friends of John Gerard* (Falls Village, Conn., 1967), pp. 30ff; P. Sidney, *Miscellaneous prose*, ed. K. Duncan-Jones and J. van Dorsten (Oxford, 1973), pp. 150, 152.

⁸² Entries for this man and his family appear in the register of St Stephen's, Walbrook (Harleian Soc. Reg. 49); he was buried in 1607. See also note 112 below.

and was apparently literate in Flemish as well as French and Italian.⁸³ There are tenuous Gresham connections in that a Dr John Gifford (relationship to Roger unknown, but Fellow of the physic College from 1598) was nominated for the Gresham professorship of music in 1596.⁸⁴ Here it may be noted that among the relevant individuals music crops up as a possible interest in common more frequently than anything else. Roger Gifford for example probably owned music parts, and Gresham himself, while apparently not leaving a library, left manuscripts of musical lessons and songs.⁸⁵ Music and medicine could, however, overlap, especially in practice.

Lastly, the last of Gresham's four medical or surgical annuitants, Dr Lankton, was evidently Christopher Langton, Cambridge-educated, who died in 1578 (that is, before Gresham's death, but after his will was written) and was buried in St Botolph's, Bishopsgate. Langton had the unusual distinction of being expelled as a Fellow of the College of Physicians for incontinency. This was in 1558, during the long presidential reign of John Caius, who also attempted to impose discipline on Cambridge students.⁸⁶ About five years later Langton was in trouble again, for a similar sexual offence. As a punishment he was carted through the streets of London to the Guildhall, in academic and penitential dress. According to Henry Machin, he had been taken in bed with two young wenches at once. Langton was never readmitted to the College of Physicians and is an excellent example of what, in terms of sexual reputation, the College sought to define as being its polar opposite.⁸⁷ In spite of, or perhaps because of, this he does seem to have succeeded as a practitioner, treating Sir William Petre and Sir Thomas Smith among others, and being pensioned by Lord Mounteagle. It is also worth noting, in relation to Gresham, that Langton was proficient in Latin and Greek but also produced at least three works on medicine in the vernacular, two of which were effectively an outline course in physic.⁸⁸ He was probably also the Dr Langton who in 1566 was called in by Thomas Keys, the

⁸³ R. G. Lewis, 'The Linacre lectureships subsequent to their foundation', in Maddison, Pelling and Webster, *Linacre studies*, pp. 235-6; *DNB*, art. 'Roger Giffard'. Nutton ('John Caius', p. 380) contrasts Gifford's library with that of Caius.

⁸⁴ See Munk, *Roll of the Royal College of Physicians of London; Register of the University of Oxford*, ed. A. Clark, 2 vols, 4 pts (Oxford, 1887-9), pt. I, pp. 128, 190, 233; pt. III, p. 149; Adamson, 'Foundation and early history', p. 76.

⁸⁵ David Mateer, personal communication, 1992; *DNB*, art. 'Sir Thomas Gresham', p. 595. On musicians in Gresham's London 'neighbourhood', see Burgon, *Life and times* II, pp. 465-6. Bishopsgate ward was by its nature attractive to physicians; *ibid.* II, p. 467; Pelling, 'Appearance and reality', p. 85.

⁸⁶ Nutton, 'John Caius', p. 373.

⁸⁷ See Pelling, 'Compromised by gender'.

⁸⁸ On Langton see Stow, *Survey* I, p. 258; *DNB*, art. 'Christopher Langton'; F. G. Emmison, *Tudor secretary: Sir William Petre at court and home* (London and Chichester, 1967), pp. 249, 251.

unfortunate imprisoned husband of Lady Mary Grey; she was transferred to Gresham's custody three years later.⁸⁹

Finally, I would now like to turn more specifically to the issue of failed transmission. In some ways the most crucial fact about Thomas Gresham was that his only son, and apparently sole legitimate offspring, died unmarried in 1563, at the age of about 16.⁹⁰ The father was later buried close to the son in St Helen's, Bishopsgate. That the failure to produce male heirs was a relatively common experience does not seem to have made it the less painful.⁹¹ In this respect, issues of generation in the early modern period conform to issues of health in general: we find anxiety, compulsion, and black humour, almost anything except indifference. The early demographers thought fertility was lower in cities and attributed it to promiscuity, as among wild animals. Generation was an area of major responsibility for a wide range of medical practitioners, including the Galenists, and it was complicated in this period for patients and practitioners alike by the widespread incidence of syphilis and other venereal diseases.⁹² There was therefore more than enough scope for playing around with the resemblances and incompatibilities of production and reproduction, and contemporary writers were more than witty enough to do so.

It is perhaps a reflection of this that the story grew up that Gresham, the man with no heirs, and whose mother died while he was in infancy, was

⁸⁹ Burgon, *Life and times* II, pp. 399n, 404.

⁹⁰ The only reliable source for the birth of Gresham's son Richard in March 1547 seems to be Gresham's account books, which detail payments to three physicians and a nurse connected with the birth: see J. Newman, 'Thomas Gresham, private person rather than public figure', *History Teaching Review Yearbook* 7 (1993), p. 17. I have been unable to obtain the names of these practitioners. The published register for St Lawrence Jewry (Harleian Soc. Reg. 70) lists the baptism on 6 September 1544 of Richard, son of Thomas Gressam; this is assumed to be Gresham's son by *DNB*. If so, Gresham's son would have had to be conceived before marriage and possibly before the death of his wife's first husband, William Reade. Gresham's son is mentioned in the will of his father Richard, written early in 1548: Burgon, *Life and times* I, pp. 42, 52. Stow's account of St Helen's church, used by Burgon (Stow, *Survey*, Bk 2, p. 101) gives 1564 as the year of Gresham's son's death, but the actual date was 2 May 1563: A. Saunders, 'The building of the Exchange', in idem, *Royal Exchange*, p. 36. For possible references by Gresham to the effects of his son's death, see Burgon, *Life and times* II, pp. 23 (cf *OED*, where 'acrassid' seems closer to 'weakened' or 'diseased' than 'crazed'), 77, 79.

⁹¹ M. Pelling and R. M. Smith (eds), *Life, death and the elderly: historical perspectives* (London, 1991), pp. 14-15.

⁹² See in general A. McLaren, *Reproductive rituals: the perception of fertility in England from the sixteenth century to the nineteenth century* (London and New York, 1984); M. MacDonald, *Mystical bedlam: madness, anxiety and healing in seventeenth-century England* (Cambridge, 1981), pp. 108-11; Pelling, *The common lot*; A. Eccles, *Obstetrics and gynaecology in Tudor and Stuart England* (Kent, Ohio, 1982), pp. 71-2; J. Graunt, 'Natural and political observations ... upon the Bills of Mortality', in C. H. Hull (ed.), *The economic writings of Sir William Petty*, 2 vols (New York, 1963-64) II, pp. 372-8.

himself a foundling – a story which offers a grasshopper, as Bindoff puts it, where Whittington had a cat.⁹³ The playwright Heywood, who in one play represented Gresham as a childless man turning to a nephew for his posterity, offered there the following piece of conventional wisdom: 'Women be forgetful, children be unkind,/ Executors be covetous, and take what they can finde'; and in another play wrote: 'Let never such despaire,/ As dying rich, shall make the poor their heyre.'⁹⁴ Gresham had made the poor his heirs only in passing, or in the guise of his eight almspeople. However, it has usually been supposed that the death of his son provided the original impetus for his foundation of Gresham College.⁹⁵

It certainly seems clear that Gresham wished to reaffirm his immediate line of *ascent*. We have already looked at resemblances between his provisions and those of his father and uncle. The Exchange was meant in some part as a fulfilment of his father's intentions; Gresham underlined his right of entry into the Mercers by virtue of his father's copy; and finally he appears to have replaced the mayoral arms on his father's tomb with the arms of his family.⁹⁶

When it comes to his line of *descent*, the picture is more complicated, but perhaps no less clear. Gresham was not without heirs: he was only without legitimate heirs of his own blood. At one time he seems to have had an arrangement with his friend and factor, Richard Clough, that each should be in some sense heir to the other; Clough drew up a document to this effect in 1570, the year of his death, but Gresham renounced it in favour of Clough's earlier will. Clough's only legitimate offspring were daughters, but he had an illegitimate, 'foreign-born' son, Richard. Gresham had one illegitimate daughter, Anne, also apparently born abroad, whom he acknowledged, educated, and provided for. This daughter, given the same name as Gresham's wife, married Nathaniel Bacon, son of Nicholas Bacon and Gresham's wife's sister, Jane Ferneley. The name and the marriage, together with what is known about the early years of Gresham's household, suggests strenuous attempts by either Gresham, or by both Gresham and his wife, to come to terms with Anne's existence.⁹⁷ This was no doubt easier during the lifetime

⁹³ *DNB*, art. 'Sir Thomas Gresham', p. 585; Bindoff, *Fame of Gresham*, p. 8.

⁹⁴ Heywood, *Dramatic works* I, p. 279; *The fair maid of the west* IV, i, in *ibid.* II, p. 309 (spoken by an alderman).

⁹⁵ Adamson, 'Foundation and early history', pp. 7–8, deprecates this emphasis as too Victorian.

⁹⁶ *DNB*, art. 'Sir Thomas Gresham'; Burgon, *Life and times* I, p. 42.

⁹⁷ *DNB*, art. 'Richard Clough', p. 586. On the early years of the Gresham household see Newman, 'Thomas Gresham, private person' and Ian Blanchard's article in this volume, pp. 13–23. For surviving correspondence of and relating to Lady Gresham, Anne Gresham/Bacon (d. 1594), and the latter's natural mother, settled in London and Isleworth as Mrs Winifred Dutton, wife of Thomas Dutton, one of Gresham's factors in Antwerp and Hamburg, see A. Hassell Smith et al. (eds), *The papers of Nathaniel Bacon of Stiffkey*, Norfolk Record Soc. 46, 49, 53 (1978–88).

of their legitimate son. Much less often mentioned in the sources is that about three years before his death, when Gresham was in his late 50s, and seemingly just after he drew up his wills, he fathered an illegitimate son by his own servant, Anne Hurst, whom he caused to marry another of his servants, John Markham, around the time of the birth, offering substantial penalties as well as inducements mainly deferred until after 1597 or the deaths of both Gresham and his wife.⁹⁸ The son, born around June 1576, was given names (John Markham) arising from the forced marriage.⁹⁹ While Gresham continued to 'frequent the company' of Anne Hurst until he died, probably in secret, he seems still to have hoped for lawful issue, only finally affirming deeds in the illegitimate son's favour, which were conditional upon Gresham and his wife dying without lawful issue (male or female), in July 1579, a few months before his death in November. That the latter condition was a legal commonplace does not preclude particular meaning in this context; it was explicitly raised in the course of the subsequent legal proceedings. The deeds were then delivered into the hands of Anne Hurst.¹⁰⁰

It is perhaps not surprising that Gresham became attached, in an overbearing and self-centred style, to the woman and child who provided such a convincing demonstration of this Indian summer of potency and fertility. In a thoroughly naïve way, he might have hoped that this Indian summer would also make fruitful his relations with his wife. The material problem here is his wife's age. As a widow with two surviving children, she cannot have been much less than eighteen when they married, which would put her at best in her early 50s when Gresham had his spring of hope. If her

⁹⁸ The existence of this son is not mentioned by Burgon, nor by his critics such as Macfarlane, nor by *DNB*. Bindoff mentions it in his iconoclastic account, on the basis of a petition of John Markham the elder calendared in *CSPD*, 1595-7 CCLXI, no. 46, ?1596, pp. 328-9 (*Fame of Gresham*, p. 22). This petition (London, Public Record Office [PRO], SP12/261, no. 46) is however part of a series of legal moves and countermoves by John Markham on one side, and Lady Gresham, her son William Reade, his wife Gertruda, and his son Thomas Reade on the other, chiefly between 1594 and 1599, and with reference to the period from about 1590, as represented by documents in *CSPD* and Star Chamber (PRO, STAC 5). About forty people were directly involved in the case. Limitations of time and space have prevented me from reconstructing the case here in its entirety. For more details on the deeds and their alleged contents (though not the reason for them), see PRO, STAC 5, M38/3. The property involved included land at Isleworth (see note 97, above).

⁹⁹ The pressures on John Markham the elder, said to be a brewer of East Smithfield, who claimed to be unable to read or write (PRO, STAC 5, G24/25; SP12/261, no. 46), may have involved more than fear, service, and the hope of reward. It is remotely possible that he was linked to the Gresham family. Paul Gresham (fl. 1550s-1560s), of the Little Walsingham branch, and one of Sir Richard Gresham's executors, was married to Elizabeth, daughter of Jeremiah Markham (Burgon, *Life and times* I, p. 488 and App. I; 'Pedigree of Sir Richard Gresham', p. 262). A William Markham was in service in 1573 with Edward Bacon, brother of Nathaniel, husband of Anne Gresham/Bacon: Smith, *Papers of Bacon ... 1556-1577*, p. 91.

¹⁰⁰ PRO, SP12/261, no. 46; PRO STAC 5, G12/32.

eldest son William was indeed born in 1539, she was probably older.¹⁰¹ That she could bear children at this age may have seemed less unlikely to Gresham than to us, and Gresham was not necessarily wrong, at least in biological terms.¹⁰² During his married life Gresham constantly referred to Anne Gresham as 'my poor wife', and that he did not wish to see himself as estranged from her is perhaps suggested both by his bequeathing her the use of his fortune during her lifetime, and by his expressions of confidence in her in his main will. Later accounts have taken both these at face value, to the advantage of Gresham, and the disadvantage of his wife.¹⁰³ However, the will could be read less positively, as a reinforcement of pressure on Anne Gresham to conform to her husband's wishes, with a warning, only too justified, about the likely verdict upon her should she resist. The quadripartite indenture of May 1575, which prefigured Gresham's will, was preceded by a string of indentures, dating from just after the death of his son, which may have contained a disposition of Gresham's property more agreeable to the feelings of his wife, and which were then revoked.¹⁰⁴ Anne Gresham may have been party to the quadripartite indenture more in name than in feeling.

A retrospective tradition alleging dissension between the couple, repeated by later accounts, stems from an anecdote in Fuller reflecting back onto an incident of 1575.¹⁰⁵ Comparing Gresham's actions to support, though not recognize, his illegitimate infant son, with his conduct earlier with respect to his illegitimate daughter, is interesting but inconclusive. It seems possible that Gresham's notion of the state of his wife's mind was both inaccurate

¹⁰¹ Burgon, *Life and times* I, p. 52; see note 106 below. It may be noted here that perhaps Gresham's only other recorded opinion on marriage was the proviso in his first will that a niece's legacy was partly dependent upon her *not* marrying before the age of 15: *ibid.* II, p. 492n.

¹⁰² Cf L. Stone, *The crisis of the aristocracy 1558-1641*, abridged edn (Oxford, 1967), pp. 77-8. Demographical calculations depend upon norms for younger women rather than on exceptions at older ages; Wrigley and Schofield, *Population history*, adopts a cut-off age for female marital fertility of 44 (pp. 254, 429-30). For contemporary instances of hopes that an older woman would produce an heir, see L. Stone, *The past and the present revisited* (London and New York, revised edn, 1987), p. 129; HMC, *Report on the manuscripts of Lord Middleton* (London, 1911), p. 553. I owe the latter reference to Anne Laurence.

¹⁰³ Burgon, *Life and times* II, p. 488. Anne Gresham was made (sole) executor only of her husband's lesser will, described by Burgon as 'a less interesting document than might have been expected': *Life and times* II, p. 491.

¹⁰⁴ For the series of indentures (but not their contents), see the Act of Parliament of 1581: Ward, *Lives of the professors*, App. VI, pp. 16-27. The second in the series follows shortly after a marriage dispensation for Gresham's daughter Anne: 'Pedigree of Sir Richard Gresham', p. 256.

¹⁰⁵ T. Fuller, *The history of the worthies of England* [1662], ed. J. Nichols, 2 vols (n. pl., 1811) II, p. 35. For a similar anecdotal tradition in Norfolk, probably also retrospective, see Burgon, *Life and times* II, p. 77.

and condescending, even while it was affectionate. What he was aware of, I would argue, was the importance to her of the sons of her first marriage, which may have increased after the death of Richard Gresham in 1563. Of the two Reade sons, Richard was dead by 1597, and the dominant figures are (Sir) William Reade, his wife Gertruda (died 1605), and their son (Sir) Thomas, who died without issue in 1595, having married Mildred, daughter of Lord Burghley. Sir William was still alive in 1621, but probably died that year.¹⁰⁶ Various of the Reades – Sir Thomas, his mother Gertruda, and another of William Reade's sons, Francis – were all buried in Thomas Gresham's vault after his lifetime.¹⁰⁷ After Gresham's death, Lady Gresham twice sought to overturn, or at least to modify, Gresham's disposition of his estate, which his biographers have seen as a grasping attack on Gresham's disinterested provisions for his College. It was the first of these attempts which led to Gresham's intentions being embodied in the Act of Parliament of 1581. However, this Act, which was seen at the time as for the settlement of Thomas Gresham's debts, may have been prompted as much by some indebtedness of Gresham to the Crown, and certainly benefited Sir Henry Nevill, the husband of Gresham's niece, by exempting him from such claims and also from conditions imposed in Gresham's main will.¹⁰⁸ Similarly, William Reade apparently resisted the 'change of use' of the Bishopsgate house c.1599, but this is usually only noted in passing.¹⁰⁹

Lady Gresham has attracted adverse comment for these and similar manoeuvres on the grounds that she already enjoyed a very considerable income. Little is certain about her views or her character, though much has been inferred. According to the surviving account books, her main entertainment as a young woman was attending the christenings of children of her friends.¹¹⁰ My hypothesis would be that her motive, if not the motive force, behind the attempts to block Gresham's intentions, was provided by Gresham's stepson and his family, against the vital background of the discovery of the existence of Gresham's second illegitimate child.

¹⁰⁶ Ward, *Lives of the professors*, p. 31. An inquisition of 1597 gave William Reade's age as 58 (ibid.). 'Sir William Read, knight' was buried in St Lawrence Jewry, the Greshams' old parish, on 23 October 1621: A. W. Hughes Clarke (ed.), *Register of St Lawrence Jewry, London, 1538-1676*, Harleian Soc. Reg. 70 (1940), p. 142.

¹⁰⁷ W. B. Bannerman (ed.), *The Registers of St Helen's Bishopsgate, London*, Harleian Soc. Reg. 31 (1904), pp. 260, 269, 276; Burgon, *Life and times* II, p. 468.

¹⁰⁸ Ward, *Lives of the professors*, App. VI, pp. 16-27. For the second attempt, in 1592, which involved leases of the Exchange, see ibid., pp. 30-1. Part of Anne Gresham's case was that the two corporations would not use the profits of the Exchange according to Gresham's intentions.

¹⁰⁹ Adamson, 'Foundation and early history', pp. 49ff. But see Bourne's reference to 'his greedy wife and her greedy son': *English merchants* I, p. 195.

¹¹⁰ Newman, 'Thomas Gresham, private person', p. 19.

Markham stated that he and his wife began borrowing on the deeds to support themselves around 1590; Markham also alleged that from around that time repeated attempts were made to buy back the deeds from him by representatives of Anne Gresham, Thomas Reade, and Thomas's mother.¹¹¹ Anne Gresham presumably knew about the child by this date.¹¹² At various points Markham testified that actions were taken in Anne Gresham's name of which she was ignorant. In one bill of complaint, Markham stated that being poor, he had approached Thomas Reade, the grandson and heir of Anne Gresham, with a view to selling one of the deeds to her. Reade offered too little, so Markham was obliged to sell to Edmund Pearshall, a grocer. If Markham is to be believed, Thomas Reade was certainly active, probably in a highly unscrupulous way, and partly by abusing his position as a Middlesex justice of the peace, in trying to discredit documents drawn up by Gresham for the benefit of his son.¹¹³ The complicated story involved the forging in 1594 of a grasshopper seal or seals and documents similar to the deeds, which could then be proved to be forged, by other agents, including one Thomas Crosse, a disgraced priest 'late of Stebenheath [Stepney]' who claimed skills in finding lost property and arranging marriages.¹¹⁴ Crosse and his associate Bilborough were acquainted with Markham, and were allegedly prompted by catching sight of the deeds; they then became co-conspirators with Thomas Reade and his mother. An attempt was made to rob Anne Gresham and to implicate Markham in this.¹¹⁵

On this interpretation, which though speculative is, I would argue, at least as viable as the alternatives, we see Gresham as a man who hoped for reproduction until the very last. The existence of sons of his wife whom he

¹¹¹ Anne Hurst/Markham was apparently dead before mid-1596, by which time Markham had remarried: PRO, STAC 5 G23/23 & G24/25.

¹¹² PRO, STAC 5, G21/27, interrogatories administered to Roger Booth, a scrivener, suggests that the documents were known before their implications were clear. This document, which gives prominence to 'Mrs Read' and 'young Markham', includes an intriguing reference to 'Mr Morryce dreame', Morris being 'very inquisitive' on behalf of Lady Gresham about the meaning of the deeds. Booth was said to have affirmed the paternity of Markham the younger.

¹¹³ PRO, STAC 5, M38/3.

¹¹⁴ PRO, SP12/261, no. 46; PRO, STAC 5, G29/18. Crosse's skill as a conjurer and finder of lost things was denied by a Ratcliffe surgeon, Peter Peers or Pierce; for a stylish 'confession' by Crosse, see the evidence of Charles Bostock, another scrivener involved in the case (PRO, STAC 5, G29/18). Pierce is probably identical with Peter Pearse, barber-surgeon 'late of Stebunheath', who was dead when his daughter married in 1612: Bannerman, *Registers of St Helen's*, p. 124. On the forging of the seal(s), see PRO, STAC 5, G21/32. On the rings and signets currently associated with Gresham, see D. Scarisbrick, 'Sir Thomas Gresham and the "grasshopper" rings', in Saunders, *Royal Exchange*, pp. 57-8.

¹¹⁵ PRO, SP12/261, no. 46. An alleged co-conspirator with Thomas Reade, and possible witness to the sealing of the deeds by Gresham, was Richard Charles, a medical practitioner: *ibid.*, PRO, STAC 5, G29/18.

did not see as his own and whom he possibly saw as rapacious explains his willingness to divert his fortune into institutional forms,¹¹⁶ but it may also explain why these plans were so lacking in detail and evidence of real engagement. Very speculatively, the puzzling marriage stipulation with respect to the professors, that we looked at earlier, may reflect Gresham's sense that while young men might well need some support, mature men with families, as his wife's sons would or should have been by the 1570s, should be able to support themselves. Thus, I would conclude, Gresham certainly hoped that the name of Gresham would be memorialized for future generations, but he had no wholehearted intention of transferring his hopes for posterity to forms of transmission other than the reproductive. At the same time, his preoccupation with human continuity can be seen as the best possible guarantee of the inclusion of a professor of physic in Gresham College.

¹¹⁶ As also suggested by Saunders, *Royal Exchange*, p. 7n.4, who also notes Gresham's 'almost obsessional' interest in the perpetuation of his name: Saunders, 'Building of the Exchange', pp. 37, 46.

Early insurance in and around the Royal Exchange

Trevor Sibbett

INTRODUCTION

This paper will be concerned mainly with early insurance in and around the Royal Exchange, but additional material will be considered where relevant. The geographical area under discussion, just to the south of the Royal Exchange and Lombard Street, can be seen at the lower left corner of the detail from John Rocque's *Plan of the Cities of London and Westminster* reproduced as Fig. 1 on p. 5. This is a small area: one can walk around it comfortably in six minutes. The events that took place in this small area span a long period of time. The importance of the Royal Exchange and Lombard Street to the history of insurance can hardly be overstated, but some of the developments that these two places stimulated occurred outside the period which is the focus of the essays published in this volume. Nonetheless, the bulk of the following discussion revolves around the general state of insurance, and matters affecting insurance, within the Elizabethan and Stuart periods.

The paper is in two sections. The first section deals with insurance events relating to Lombard Street and the surrounding streets, alleys and lanes. Change Alley, Birchin Lane, Pope's Head Alley and Nicholas Lane in particular will be discussed, but the two latter places only briefly since important developments took place there only after the end of the Stuart period. Change Alley will also be referred to in the second section, as the South Sea Bubble speculation which took place in this alley gave birth to a number of insurance ventures of which two survived and one, Royal Exchange Assurance, remains important today. The second section of the paper deals with the Office of Assurances of 1576 in the Royal Exchange, the first recorded United Kingdom life assurance policy in 1583, Queen Elizabeth I's insurance act of 1601,¹ and finally, briefly, the rather later founding of Royal Exchange Assurance.

¹ This document is London, House of Lords Record Office, 43 Eliz c 12; see H. E. Raynes, *A history of British insurance* (London, 2nd edn, 1964), p. 53.

EARLY ORIGINS OF INSURANCE IN THE ROYAL EXCHANGE

By the sixteenth century, merchants gathered in Lombard Street to do their deals, including insurance.² Precisely in which part of Lombard Street they congregated is, however, not clear. It may have been near Pope's Head Alley, which was granted to rich Florentine merchants in the year 1318.³ Alternatively, it may have been close to the house that Sir Thomas Gresham occupied up to about the year 1560. This site, 68 Lombard Street, is an empty building today, a casualty of recent economic crises and reorganizations; it had been occupied by a bank, Messrs Martin & Co., since 1815 and perhaps earlier. A very large golden grasshopper, Sir Thomas Gresham's sign, is attached to the wall of the building.

The first suggestion, made by Richard Gresham in 1538, that a bourse should be built in London came to nothing. In 1564 Richard Gresham's son, Thomas, agreed to pay for a bourse from his own pocket if the citizens of London would pay for the purchase of the ground.⁴ Construction of Sir Thomas Gresham's London bourse was completed in 1569, and in 1571 Queen Elizabeth I dined with Sir Thomas in his house in Bishopsgate. A magnificent Flemish damask tablecloth, which the Queen and Sir Thomas Gresham are reputed to have used at that meal, is, as mentioned by Ann Saunders on p. 7 of this volume, on display in the Royal Exchange and is one of the objects preserved there, amongst many other items of historical interest, worth special attention. After the meal Queen Elizabeth visited the bourse and proclaimed that in future it should be named The Royal Exchange. The Royal Exchange became a centre of insurance almost from the day it was built, and it remains an insurance centre to the present day.

BIRCHIN LANE

An important resident in Birchin Lane was John Graunt, whose work has had a major influence which has lasted up to the present day.⁵ Before considering his contribution, however, it must be explained what a Bill of Mortality is. Bills of Mortality are lists of burials extracted from parish registers, and the responsibility for producing them lay with the Fraternity of St Nicholas, later renamed the Company of Parish Clerks. The first London Bills were issued in the sixteenth century, and other towns followed suit

² For additional information, see Trevor Sibbett, 'Early insurance and the Royal Exchange', in Ann Saunders (ed.), *The Royal Exchange* (London, 1997), London Topographical Society 152, ch. X, p. 254.

³ Kenneth Rogers, *Old London* (London, 1935), p. 14.

⁴ Ann Saunders, *The Royal Exchange* (London, 1991), p. 7.

⁵ E. S. Pearson (ed.), *The history of statistics in the 17th and 18th centuries* (London, 1978), p. 11.

later.⁶ In London, the Bills seem to have been issued sporadically at first and only in years when there were epidemics of plague – for example for the period from 1592 to 1595. There is, however, no record of any Bills being issued in 1597, the key year for the foundation of Gresham College. Handwritten until 1629, Bills of Mortality were issued both weekly and annually regularly from 29 December 1603 until the last century, although few of the early Bills survive. These Bills contain information in addition to deaths, and over the years they became more complex. In the early seventeenth century, mortality was seriously affected by various localized epidemics including typhus, typhoid, smallpox, bubonic plague, influenza and various undetermined fevers.⁷ The title-page of the Bills of Mortality for 1665 is headed by a sand timer, no doubt to indicate the expiry of the allotted time of life. It shows at the base a skull and cross-bones, grave diggers' tools and what may be a burial shroud: until the middle of the last century only wealthy people were buried in coffins, and the others had to make do with a shroud. The coats of arms are those of King Charles II, the City of London and the Company of Parish Clerks. A border of skull and cross-bones alternating with a sand timer was still being used for the weekly Bills of Mortality in 1757.

The 1665 Bills of Mortality for London are particularly interesting because this was a very severe plague year. At the end of 1665, the Bills of Mortality were collected and sold in a single volume. The long annual Bill for 1665 gives information on christenings as well as deaths: there were 97,306 burials in that year, but only 9,967 christenings.⁸ Births were not noted and a child that was not christened in the Church of England was not recorded. The causes of death are also given, but merely in terms of symptoms which are not always easy to understand. Baptised children under the age of one month are listed as chrisomes: the cause of death is not given for these children. The list of 'Diseases and casualties this year' includes three deaths from 'Calenture', a fever or delirium; 1,288 from the self-explanatory 'Griping in the Guts', 227 from 'Impostume' – that is, abscesses – and 86 from 'Kings Evil', scrofula, or tuberculosis of the lymph glands. Starvation, which is not limited to lack of food but includes the effects of cold, is a cause of death often included in Bills of Mortality, but does not appear in the 1665 list; 397 deaths are recorded by 'Rising of the Lights', probably pneumonia, and finally one person died of

⁶ Steven Haberman and Trevor Sibbett, *History of actuarial science*, 10 vols (London, 1995) I, p. 8; and see further in this work for material on Ulpian's Table, Bills of Mortality, John Graunt, and James Dodson.

⁷ For this, see M. J. Dobson, *A chronology of epidemic disease and mortality in southeast England, 1601-1800*, Historical Geography Research Group (London, 1987).

⁸ For this Bill, see Company of Parish Clerks of London, *London's Dreadful Visitation, or a collection of all the Bills of Mortality for this present year* (London: E. Coates, 1665).

'Wenn', which is a wart or a similar type of swelling. In 1665, 68,596 Londoners died of the plague. This had been preceded by a severe pestilence in 1663 which turned into a malignant fever in May 1664; in June 1664 it assumed an aggravated form and in November true plague broke out. Other antecedent events were multitudes of flies, swarms of ants which could be taken from the highways in handfuls, and numberless frogs and insects;⁹ and many of the population probably also had fleas and scabies.

There are quite detailed figures of this type available for all years from 1629.¹⁰ John Graunt was the first to study the Bills of Mortality, and in 1662 he published the results of his study in a major work titled *Natural and Political Observations mentioned in a Following Index and made upon the Bills of Mortality*. This work is a remarkable compendium of data classification and data comparison. Graunt draws a number of conclusions, such as that the country is healthier than towns, that more males are born than females, and that females are sick more often than males. He also discusses the causes of death and notes that some causes of death were declining and others were increasing. Economic questions, such as how much hay per acre every sort of meadow should bear are also addressed. Graunt also produced an interesting mortality table. Poul Klingenberg in Denmark had included a rudimentary life table nearly ten years earlier in the promotion of an unsuccessful tontine scheme in 1653,¹¹ but it was not noticed and had no effect; and the Roman Jurist Ulpian produced a life table, or something like it, in about 220 AD.¹²

Against Graunt's mortality table in Table 1, numbers from a modern mortality table have been added for comparative purposes.

Graunt's table is little more than a very intelligent guess, because he had no information on ages in the Bills of Mortality and the decrease in the number of lives with increasing age is not accurate. However, the mortality rates for infants were very high indeed and eighteenth-century mortality tables for London sometimes show that over 50 per cent of children were dead by the age of three.¹³ Further the number zero at age 80 does not mean that nobody over the age of 80 was still alive, but merely that there were so few that the percentage figure was too small to register.

⁹ See Cornelius Walford, *A statistical chronology of plagues and pestilences as affecting human life, with an enquiry into their causes* (London, 1884), p. 108.

¹⁰ J. Marshall, *Mortality of the metropolis* (London, 1832); and see also Haberman and Sibbett, *History of actuarial science* (London, 1995).

¹¹ Anders Hald, *A history of probability & statistics and their applications before 1750* (New York, 1989), p. 128.

¹² Haberman and Sibbett, *History of actuarial science* I, pp. 3-5; and Hald, *A history of probability & statistics* p. 117.

¹³ For this, see *inter alia* Richard Price, *Observations on reversionary payments* (London: T. Cadell, 2nd edn, 1772), p. 333.

Table 1. Graunt's 1662 Mortality Table and a 1980 Mortality Table compared

Age	Graunt's 1662 table: number surviving from 100 baptised	1980 Mortality Table: number surviving from 100 born
6	64	100
16	40	99
26	25	99
36	16	98
46	10	97
56	6	93
66	3	81
76	1	57
80	0	43

The first person in the United Kingdom to take up Graunt's work and develop it further was William Petty, the third Gresham Professor of Music, who called his work 'Political Arithmetic'. Later, Graunt's work was further developed by well-known scientists including Edmund Halley, of comet fame. The study of Bills of Mortality led to the development of mortality tables based on evidence of deaths, and thence to more accurate pricing for life assurance. Graunt was made a Fellow of the Royal Society on the strength of his work, but he does not seem to have been popular. The Company of Parish Clerks complained that he borrowed their registers (Hall Books) and did not return them: these registers were, no doubt, destroyed in the Great Fire of London. Graunt was accused of cutting off the water in the New River at the time of the 1666 fire, and later he put himself at a further disadvantage by becoming a Roman Catholic.¹⁴

LOMBARD STREET

Lombard Street was an important area, and together with the Royal Exchange was a magnet for insurance. From 1694 Edward Lloyd's coffee house was located in Lombard Street, almost opposite where Gresham's house stood earlier. Lloyd's coffee house was on the site now occupied by Coutts Bank, Lombard Street. The Coutts numbered amongst the wealthy bankers who in 1821 set up Guardian Assurance, which occupied 11 Lombard Street nearby. The inaugural meeting of the Institute of Actuaries in 1848 took

¹⁴ Pearson (ed.), *History of statistics*, pp. 10-47.

place in those offices in 11 Lombard Street.¹⁵ Guardian Assurance later merged with Royal Exchange Assurance to form the Guardian Royal Exchange Assurance, well-known today.

By popular repute, it was at Edward Lloyd's coffee house that the current institution of Lloyd's insurance market was first established. In fact there seems to be no evidence that marine insurance was transacted in this coffee house during Lloyd's lifetime - he died in 1713 - or indeed until after 1720.¹⁶ It is however known that ships were auctioned at Lloyd's coffee house by inch of candle, and similar auctions were held in other coffee houses, such as Hain's in Birchin Lane (later known as the Marine Coffee-house), John's - also in Birchin Lane - and Garraway's in Change Alley. In these auctions the last bid made before the inch of candle burnt out was successful. Certainly too, news of ships' fortunes was available at Lloyd's coffee house. This would have been useful both for underwriters and - especially - for merchants whose fortunes rested on the hazards of voyages. Edward Lloyd started a newspaper, *Lloyd's News*, which however failed after a short time: *Lloyd's List*, a daily newspaper that still flourishes, started later, in 1734.¹⁷

It seems likely, also, that marine insurance was transacted in Lloyd's coffee house and in other coffee houses opened in the second half of the seventeenth century. But as a marine insurance centre, Lloyd's still had to develop: indeed, it appears probable that the formation of Lloyd's as an underwriting market was mainly a reaction of the underwriters to the formation of Royal Exchange Assurance in 1720. The War of Jenkins' Ear established Lloyd's reputation as an up-to-date source of information when, in 1740, news of Admiral Vernon's capture of the *Portobello* was first received by Lloyd's and was passed on by Lloyd's to Robert Walpole.¹⁸ By this date the Lloyd's marine insurance market was certainly well established, although underwriting was not yet a separate profession. The earliest record, in the journal of John Eliot, a well-known London Quaker, of a subscription as an underwriter to Lloyd's is dated 1757.¹⁹ In 1769, Lloyd's moved to number 5 Pope's Head Alley and stayed there until 5 March 1774 when it moved again to the north-east corner of the Royal Exchange. There it was to stay for about 150 years, apart from a short interruption as a result of the destruction of the Royal Exchange by fire in 1838 - a fire that is reputed to

¹⁵ *Journal of the Institute of Actuaries* I, (London, 1851), p. 103.

¹⁶ D. E. W. Gibb, *Lloyd's of London* (London, 1957), pp. 17-18.

¹⁷ See Ernest Wright and Charles E. Fayle, *A history of Lloyd's* (London, 1927), p. 73; and Ralph Straus, *Lloyd's: a historical sketch* (London, n. d. (1940?)), p. 59.

¹⁸ See Gibb, *Lloyd's of London*, p. 35; and Straus, *Lloyd's: a historical sketch*, p. 66.

¹⁹ Straus, *Lloyd's: a historical sketch*, p. 71.

have started in Lloyd's Rooms. The Lloyd's market moved finally from the Royal Exchange to Leadenhall Street in 1928.

Royal Exchange Assurance occupied the south-west end of the Exchange building from its foundation in 1720, and this is still its position today. Interestingly, Malynes says that the Office of Assurances, described below, occupied the west end of the Royal Exchange,²⁰ and one might speculate that its position was the same as that occupied by the eponymous assurance company. The London Assurance occupied the south-east end of the building, to the right of the Royal Exchange courtyard entrance from Cornhill.

CHANGE ALLEY

Change Alley, named after the Royal Exchange, is merely an abbreviation for the name 'Exchange Alley'. It runs from Lombard Street up to the old entrance to the first and second Royal Exchanges. This alley was the centre of the activity, or rather perhaps the scandal, of the South Sea Bubble. In 1720 the South Sea Company put forward a scheme to take over the national debt.²¹ This sparked off all manner of speculative schemes and projects for which money was to be raised by subscription, and there was much speculation in stocks bought and sold by the stockbrokers of Change Alley, who were centered on Jonathan's coffee house and who included several promoters of schemes to form insurance companies. The speculative fever caused a major financial boom. During the heat of the speculation, Thomas Bowles, a print-seller of St Paul's Churchyard, published a pack of playing cards satirizing fifty-two of the speculative projects. Five of the projects illustrated on the cards were concerned with insurance (Plates 2-4). The first is the *Seven of Clubs* which is entitled 'Rose Insurance from Fire': the company is identifiable by the fire mark over the door. This was to indicate that this company insured the building and that it was the company's fire brigade that had to put out any fire there. While the firemen are extinguishing the fire, another man is setting light to the unburnt parts with a torch. The quatrain at the bottom of this card reads:

Projecting sure must be a Gainfull Trade,
 Since all the Elements are Bubbles made,
 They're right that gull us with ye Dread of Fire,
 For fear makes Greater Fools, than Fond Desire.

²⁰ See Gerard Malynes, *Consuetudo, vel, Lex Mercatoria: or, the ancient law-merchant*, printed by J. Redmayne at the Royal Exchange in Cornhill, London, 1685 (facsimile edition London, 1991).

²¹ See Charles Mackay, *Extraordinary popular delusions and the madness of crowds* (London, 2nd edn, 1852); reprint, ed. Norman Stone (London, 1995), pp. 46-88.

The *Queen of Clubs* represents an unknown company which offered bottomry, a form of marine insurance which will be considered later, to the merchants:

Some lend their Money for the sake of More,
And Others borrow to Encrease their Store:
Both these do oft Engage in Bottom Ree
But Curse sometimes the Bottome of the Sea.

The company illustrated on the *Four of Diamonds* aimed to raise £2 million. Even today the insurance of horses is a particularly tricky problem, and dying horses are well illustrated in the picture on this card:

You that keep Horses to preserve your Ease
And Pads to please your Wives, and Mistresses:
Insure their Lives, and if they Die we'll make
Full Satisfaction, or be bound to Break.

Finally, the *Six of Spades* (Plate 4) satirizes an unknown life assurance company. The verse at the bottom shows that not much has changed:

Come all ye Gen'rous Husbands, with your Wives.
Insure round Sums, on your precarious Lives;
That to your comfort, when you're Dead & Rotten,
Your Widows may be Rich when you're forgotten.

Royal Exchange Assurance was one of only two South Sea Bubble companies that survived. A few people made a lot of money from speculation in the Alley, including Thomas Guy who owned a bookshop at the corner of Cornhill and Lombard Street and who founded Guy's Hospital with proceeds of his investment.

NICHOLAS LANE

The parsonage of St Nicholas Acons in Nicholas Lane was the site of the first life office to transact life assurance on a scientific basis, in 1762.²² The church was destroyed in the Great Fire of London and only the parsonage was rebuilt. The premiums charged for the first scientifically based life assurance policies were based upon the average ages of death calculated by Corbyn Morris from the London Bills of Mortality for the years 1728–51. In 1728, ages at death had for the first time been inserted into the Bills of Mortality, and this was an important advance. The new development in mathematics was due to James Dodson, who did not live to see his work put into practice. Suffice it to say that Dodson's work²³ had the result that

²² See Maurice Edward Ogborn, *Equitable assurances* (London, 1962), p. 50.

²³ Haberman and Sibbett, *History of actuarial science* III, p. 156.

insurance companies were able to quote level annual premiums for increasing or fluctuating risks, and to develop premiums which were differentiated by age. The bulk of the theoretical development of life insurance mathematics and the commercial practice of life assurance took place in London over a period of about three centuries.

The area around the Royal Exchange and Lombard Street was thus the cradle of insurance in the same way that Fleet Street was the cradle of the newspaper industry. Forty-five years ago insurance companies were located in profusion from Bow Churchyard in the west to the City of London boundary in the east. King William Street was lined with these companies, as was Cornhill and Threadneedle Street. In the last forty-five years, however, many of these have relocated or amalgamated. The Lloyd's market, the Institute of London Underwriters, the London Underwriting Centre, the Insurance Institute of London and a relatively few companies remain. The Royal Exchange is still an important insurance centre and it remains the registered office of the Royal Exchange Assurance of 1720, which today is a subsidiary of Guardian Royal Exchange plc. Commemorative blue plaques at the sites of Lloyd's and Jonathan's coffee houses, and in Nicholas Lane, commemorate the beginnings of scientific life assurance. No recognition is given in Birchin Lane, however, to the very important work of John Graunt.

EARLY MARINE INSURANCE AND BOTTOMRY

The second section of this essay will concentrate on legislation and law cases, since these are the main records available. Insurance men have always tended to dispose of paper as soon as it has served its purpose. Obviously, the Great Fire of London in 1666 also removed many of the other remaining early records. Marine insurance in the form of bottomry was known to the Romans,²⁴ but when or where this type of insurance was developed cannot now be ascertained. The earliest record of a life assurance policy dates back to fifteenth-century Genoa and was written in Latin.²⁵ A reference to a marine insurance policy effected in Antwerp in 1557 records that the policy shall be subject to the customs of Lombard Street, and there are other policies of this time with similar provisos; while the earliest reference to the Royal Exchange in a marine insurance policy is in 1571.²⁶

²⁴ For discussion of ancient insurance, see Samuel Marshall, *A treatise on the law of insurance in four books* (Boston, 1805), pp. 5-8.

²⁵ J. Lefort, *Traité théorique et pratique du contrat d'assurances sur la vie* (Paris 1894), I, pp. 35-6.

²⁶ I am indebted to Professor John Baker, of St. Catherine's College, Cambridge, who kindly pointed out the 1571 reference to a marine insurance case mentioning the Royal Exchange, in Cambridge, UL, MS Hh. 2. 9, f. 23r.

Bottomry is basically a form of loan combined with insurance.²⁷ The word itself, which derived from an old Dutch word meaning the bottom of a ship, is relatively modern, probably dating from the late sixteenth century. In London the use of bottomry was linked to legal prohibitions on the maximum rate of interest which could be charged on loans. Lending money on ships' cargoes and on the ships themselves was a risky business: many merchants would lose money heavily if their goods were lost at sea, and a number would be unable to repay loans. With a contract of bottomry, the lender received his money back only if the ship and its cargo came safely into port. In effect the bottom of the ship was insured, since if it did not arrive the loan was cancelled. The interest on the repayment on the loan was very high, often 30 per cent or much more - Malynes quotes interest in 1685 of up to 50 per cent per annum, depending upon the hazard of the sea²⁸ - and for this reason bottomry was not popular.

THE OFFICE OF ASSURANCES IN THE ROYAL EXCHANGE IN 1576

Events can occur with regard to insurance which were not contemplated by either the underwriter or the insured. Both may then turn to the policy document to ascertain their rights. Normally in this situation underwriters would pay claims without dispute if they had intended the insurance to cover the event that occurred, even if the policy had not been expressed properly. If however the underwriter declined to pay, the person insured could turn to the courts for adjudication. In sixteenth-century London disputed insurance matters were dealt with by the Court of Admiralty, the Privy Council and the Lord Mayor of London.²⁹ It is due to the fair and even-handed way these disputes were handled that London maintained its reputation for insurance.

But wherever there is insurance, there are fraudsters: for some reason, insurance seems to bring out the worst in some people. In order to bring more transparency to insurance, the Privy Council set up an Office of Assurances in the Royal Exchange in 1576. The purpose of the Office of Assurances was to write the policy documents and to register the insurance. Both public and underwriters were then able to see the terms on which policies were written. As a result of this anti-fraud measure it became more difficult to insure the same ship more than once, or for excessive sums. Insurance which is too large for the circumstances is one of the early signs of fraudulent practices. Independent commissioners were appointed to act as arbiters in the case of disputes, and to determine fees payable to

²⁷ Marshall, *A treatise on the law of insurance*, pp. 632-7.

²⁸ Malynes, *Consuetudo*, p. 122.

²⁹ H. E. Raynes, *History of British insurance*, pp. 38-69.

the registrar for his work. If the insurers did not submit to the judgement of the commissioners they could be committed to prison.

The first registrar to be appointed was Richard Candeler, an agent and associate of Thomas Gresham. Candeler was dissatisfied with the level of fees he was allowed, but nevertheless he did his work satisfactorily and the Office of Assurances worked tolerably well. If no insurance broker was involved in the insurance, Candeler could claim commission. Brokers and notaries were upset, however, since they used to draw up policies and the Office of Assurances took away this part of their work. Although the registration of insurances and the drawing up of assurance policy documents by the registrar were compulsory, in practice not all policies were registered and the commissioners sometimes turned a blind eye to problems.

The Privy Council wished the rules of insurance to be followed by the Office of Assurances to be set down in writing and to follow the customs of the merchants of Lombard Street and the Royal Exchange.³⁰ The rules were entitled *A Booke of Orders of Assurances within the Royall Exchange London*. There was some delay in producing these orders, but the last complaints, when the orders were said to be nearly complete, were lodged in early 1577, so the work was presumably finished in that year. The undated manuscript,³¹ held in the British Library, runs to 126 detailed articles on the conduct of insurance. Only seven of these articles refer to life insurance: the remainder are about marine insurance, which reflects the relative importance of the two forms of insurance at that time. The perils which the assurers shall bear and the rules for insuring gunpowder, wines, gold and silver also take up only a small part of the articles. On the life assurance side we learn that most policies were effected in connection with voyages; that no man shall assure another man's life without good cause; and that when a person assured has been missing for more than three years he may be presumed dead.

THE FIRST RECORDED ENGLISH LIFE POLICY IN 1583

A dispute in 1583 over a life assurance policy was resolved by the Court of Admiralty, and the court's decision was ratified by the Privy Council. The law report of the case contains the complete policy details.³² This is the earliest detail we have on life policies in the England. The policy was written by Richard Candeler in the Office of Assurances in the Royal Ex-

³⁰ Ibid., p. 46.

³¹ *A Booke of Orders of Assurances within the Royall Exchange London*, British Library, Harleian MS 5103, ff. 154-85; for a selection and notes of the main points detailed in this manuscript, see C. G. Lewin, '1848 and all that', *The Actuary*, March 1991 and November 1991.

³² For the Privy Council's law report dated 1583 on William Gybbons's life assurance policy, see London, British Library, Lansdowne MS 170, f. 123.

change and includes words indicating that the policy followed the insurance customs of policies previously written in Lombard Street and the Royal Exchange. The sum assured on the policy was £333 6s 8d payable in the event of the death of William Gybbons within twelve months of 18 June 1583. Sixteen different underwriters had a share of the risk. William Gybbons died on 29 May 1584 and the underwriters refused to pay the sum out. The underwriters claimed that the normal law of the realm for transactions between man and man not being merchants should apply, which meant that each month counted as 28 days. On this basis the policy had expired before the death of William Gybbons. Richard Martin, who owned the policy, claimed that 12 months meant a whole calendar year. A number of merchants swore that 12 months in the custom of Lombard Street and the Royal Exchange meant a whole year, and Richard Candeler swore likewise. The underwriters lost their case and had to pay up.

QUEEN ELIZABETH'S INSURANCE ACT OF 1601

In 1601 the city merchants expressed their dissatisfaction over the operation of the Office of Assurances, particularly as some individuals refused to place themselves under the jurisdiction of the commissioners to settle disputes. In these cases the disputes were settled in Her Majesty's courts, which led to delays and expense. A petition to the Privy Council was followed by the Insurance Act of 1601.³³ The act set up a new commission associated with the Office of Assurances with increased powers such that it was effectively a court of law. This is the first English statute enacted to regulate insurance, and it is notable for its clear descriptions. It is worth noting in the act the use of the words 'time out of mind', which indicate that insurance was recognized then as a very old form of commerce. Furthermore, the words 'the loss lighteth rather easily on many than heavily upon few' already offer as good a description of the principle behind all insurance as it is possible to reach. However, this act also had weaknesses, of which the principal one was, perhaps, that the commissioners were not paid for their services. As a result, they were accused of neglecting their duties and despite additional acts in 1627 and 1662 the Office of Assurances gradually died a slow death through disuse. The last reference to the existence of the Office was in 1693.

FIRE INSURANCE

Fire had always been a peril covered under marine policies: there was no fire insurance in Great Britain on property or goods on land before the

³³ London, House of Lords Record Office, 43 Eliz c 12; see Raynes, *History of British insurance*, p. 53.

Great Fire of London.³⁴ Some evidence exists of early fire insurance practised in Germany and elsewhere by members of guilds or closed mutual groups.³⁵ The recorded introduction of fire insurance on a commercial basis open to the public in general was a late reaction to the Great Fire. This first commercial fire office was founded in London by a speculative builder, Nicholas Barbon, and three colleagues in 1681.³⁶ The office of Nicholas Barbon, widely known as Barebones, was advertised as being located at the backside of the Royal Exchange, and insured houses against fire. The fire office promoted shortly afterwards by the City of London authorities lasted for only a couple of years; and two other fire offices were promoted before the turn of the century. On 22 November 1682 the *London Gazette* published a report of a fire that had started two nights previously:

London, November 22. On Sunday Night a dreadful Fire broke out in *Cinnamon-Lane* in *Wapping*, occasioned by the carelessness of an idle Fellow, which burnt furiously, the Wind blowing very hard at South West, that notwithstanding the great Care and extraordinary Endeavours that were used, it consumed many hundred Houses, and was not quite overcome and extinguished till Monday at Night.

Shortly thereafter appeared an advertisement for Barbon's fire office, reporting its willingness to settle claims early subject to a deduction for interest:

These are to give notice to those Persons whose Houses were burnt or demolished in the late Fire in *Wapping*, which were Insured at the Office on the Backside of the Royal Exchange, That although there is some time allowed by their Policy for the Payment of the Money, yet if they have occasion for their Money in the Interim, they may receive it at the Office upon discount of the Interest for the time it shall be paid before it is due.

It can confidently be claimed that fire insurance on a commercial basis started in the Royal Exchange.

THE FOUNDATION OF ROYAL EXCHANGE ASSURANCE

The income raised from rents on the Royal Exchange building is used to pay for the Gresham professors or, in other words, for Gresham College. One company has been a tenant in the building for nearly three centuries and for this reason it is worth looking at the circumstances of the company's formation. Individual insurance underwriters had always experienced finan-

³⁴ Ibid., p. 74.

³⁵ For discussion of the early German fire insurance of Wilhelm Stiell, see Peter Koch, *Pioniere des Versicherungsgedankens 1550-1850* (Wiesbaden, 1968), p. 31.

³⁶ Raynes, *History of British Insurance*, p. 75.

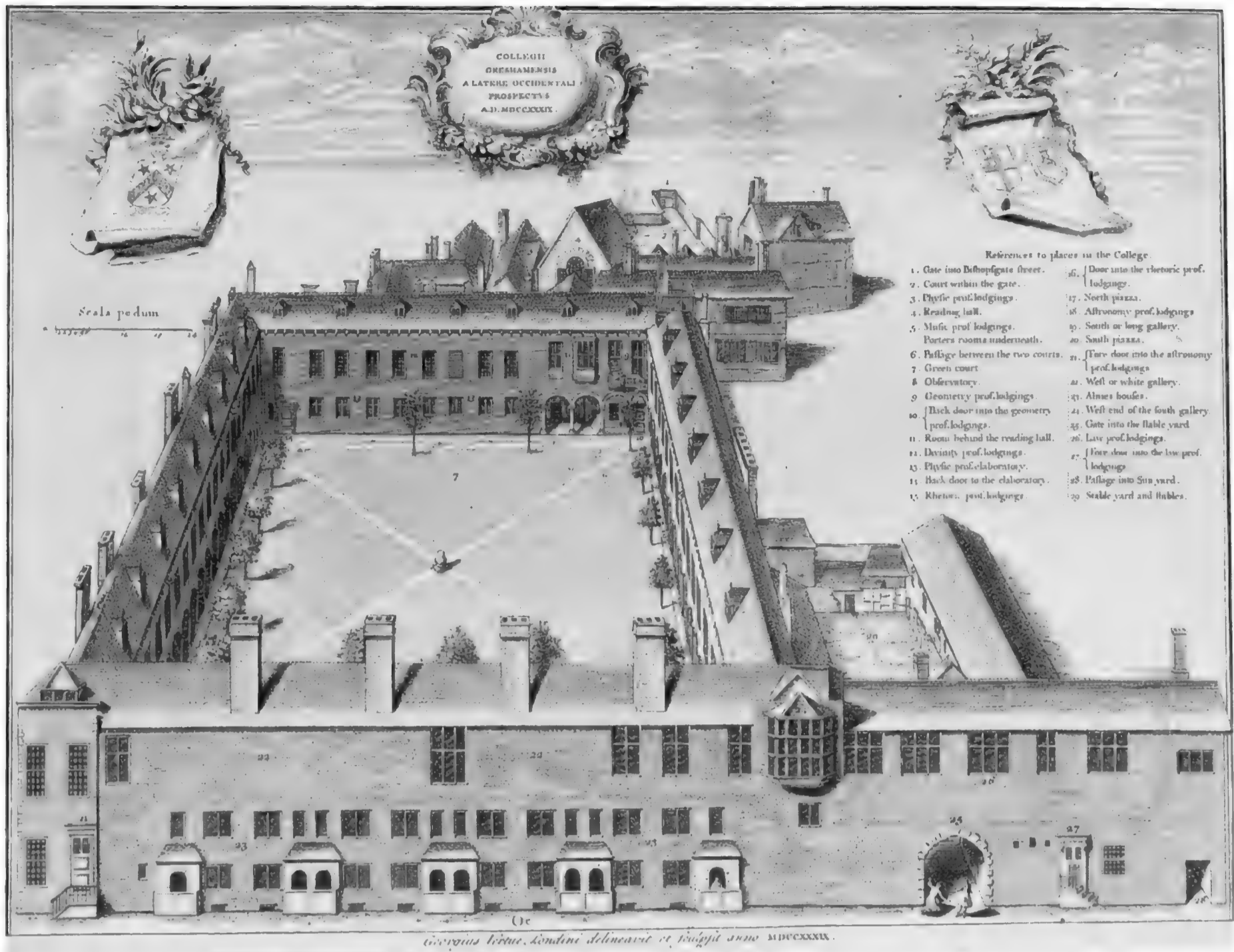


Plate 1 George Vertue, Gresham College on Bishopsgate. (Engraving for *J. Ward, Lives of the Professors of Gresham College, London, 1740.*) Guildhall Library, Corporation of London.

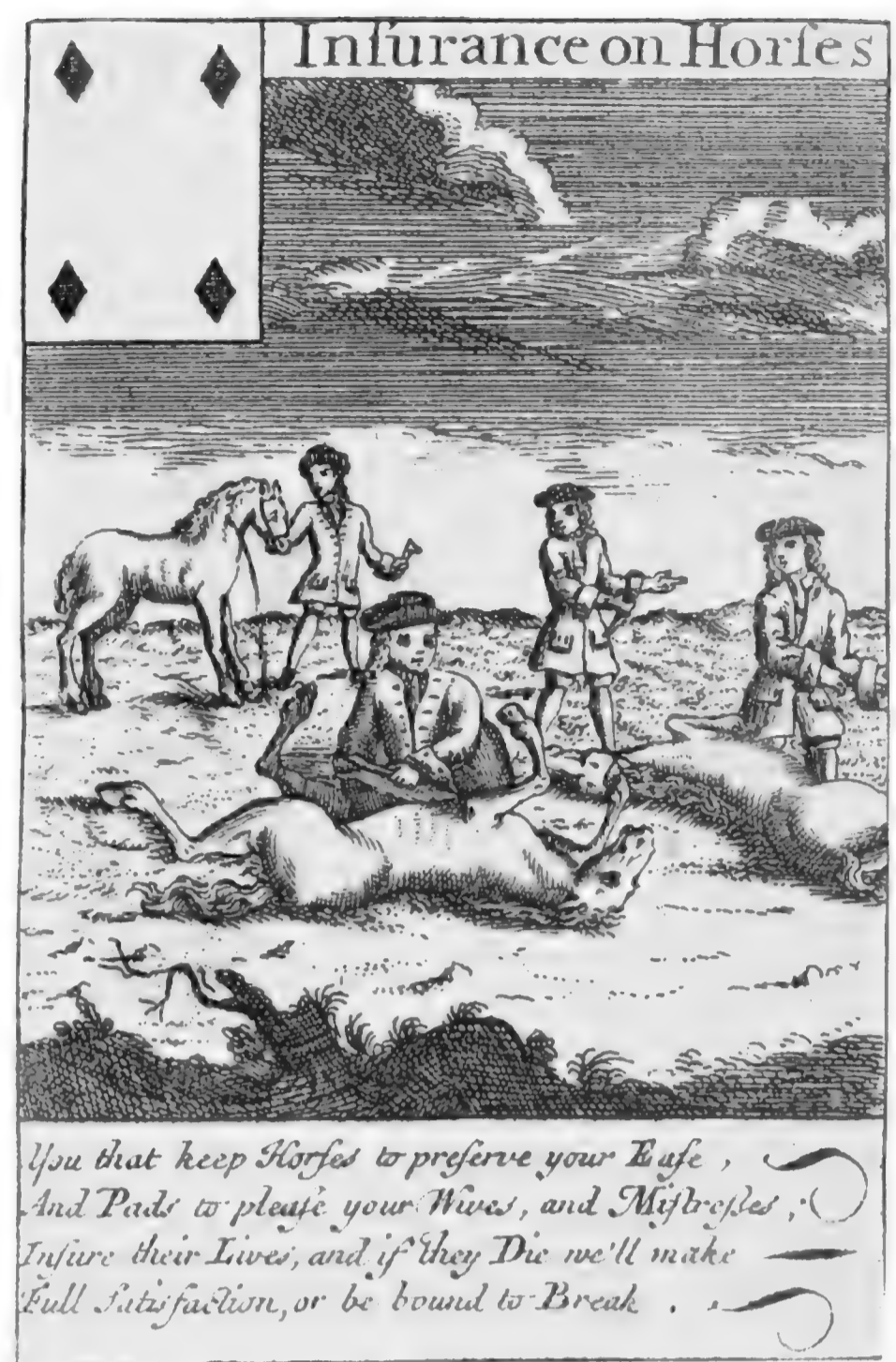
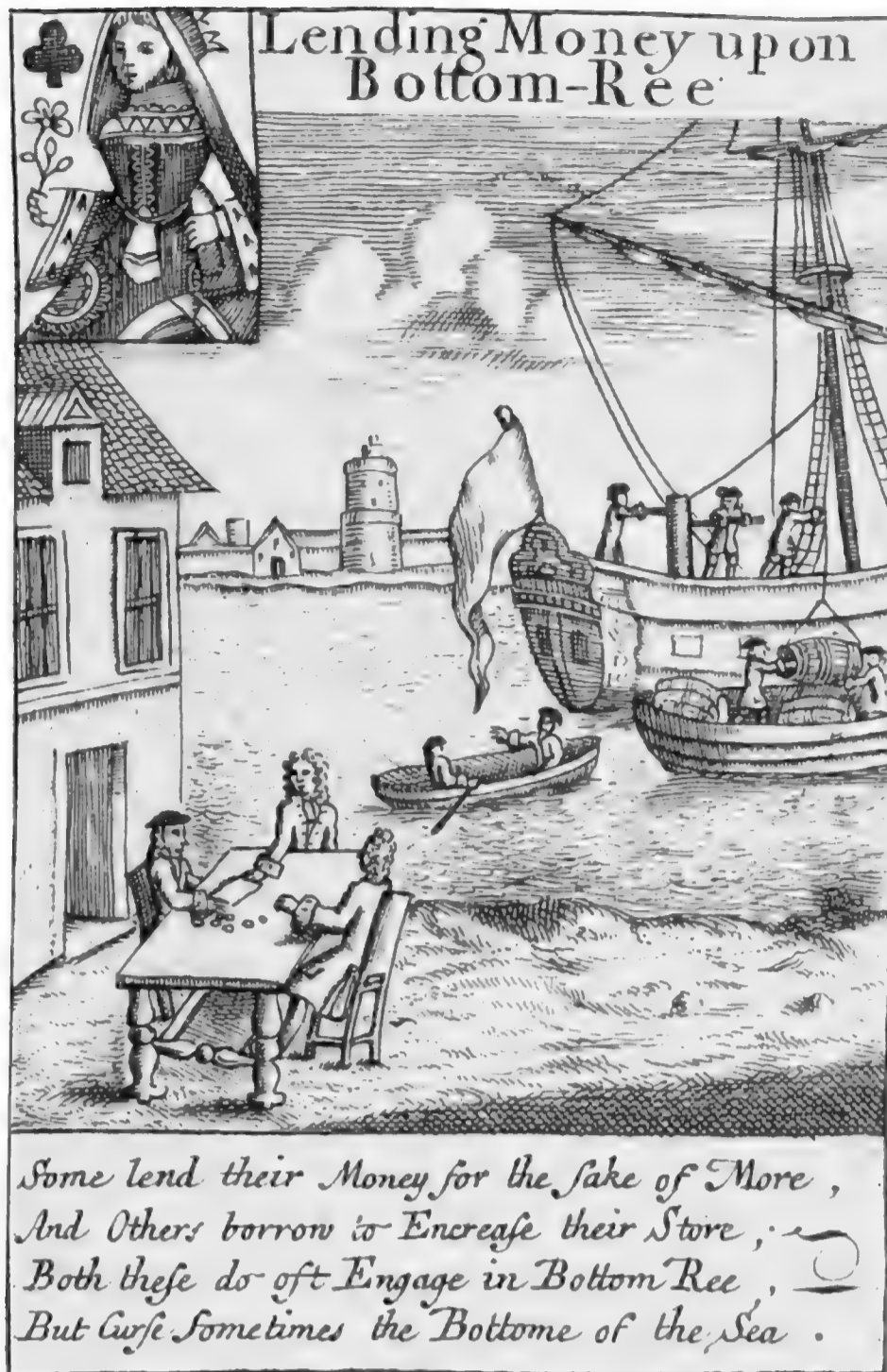


Plate 2a & b Queen of Clubs and Four of Diamonds (from Thomas Bowles' satirical playing cards, c.1720). Oxford, Worcester College.

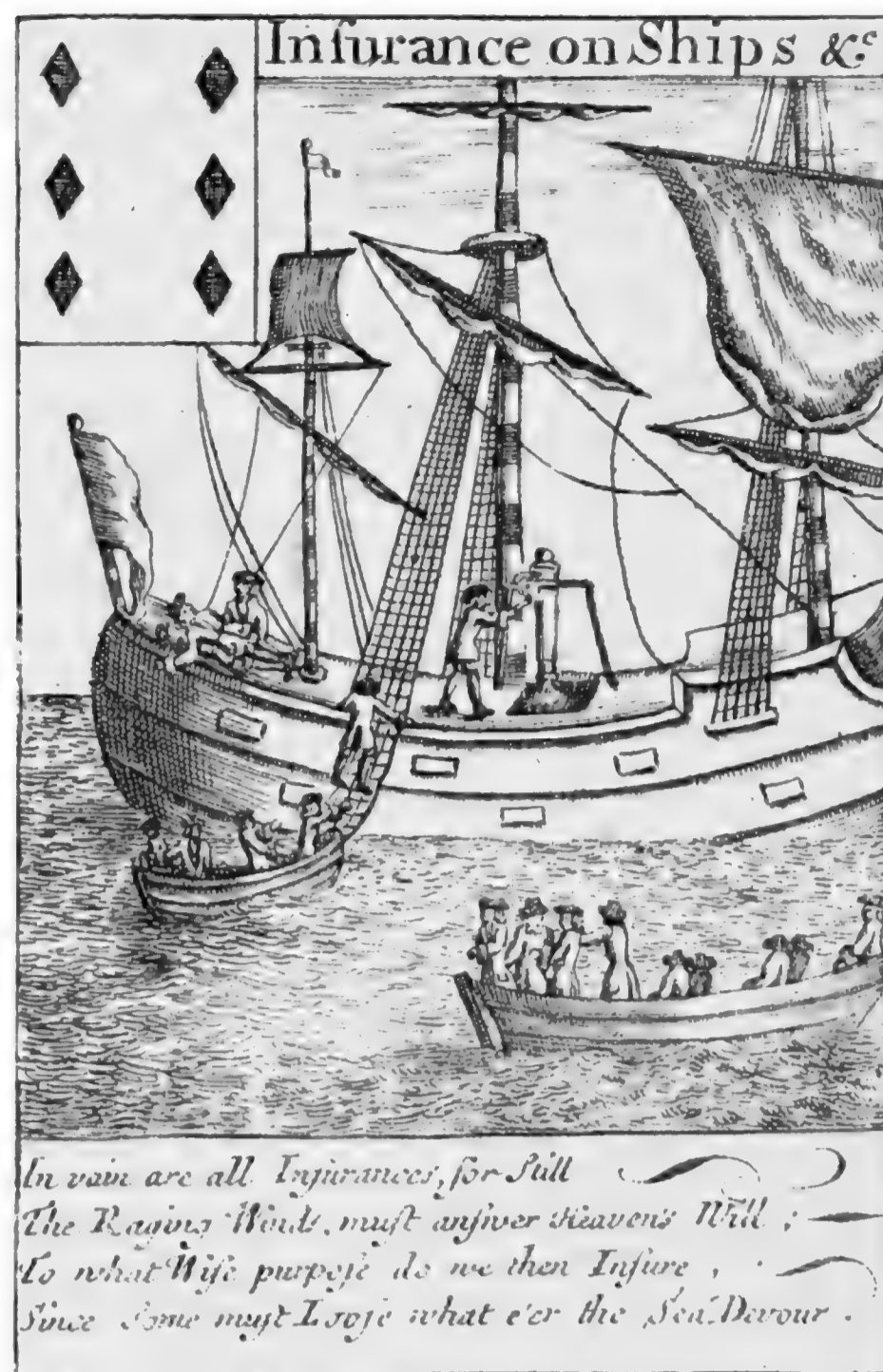


Plate 3a & b Six of Spades and Six of Diamonds (from Thomas Bowles' satirical playing cards, c.1720). Oxford, Worcester College.

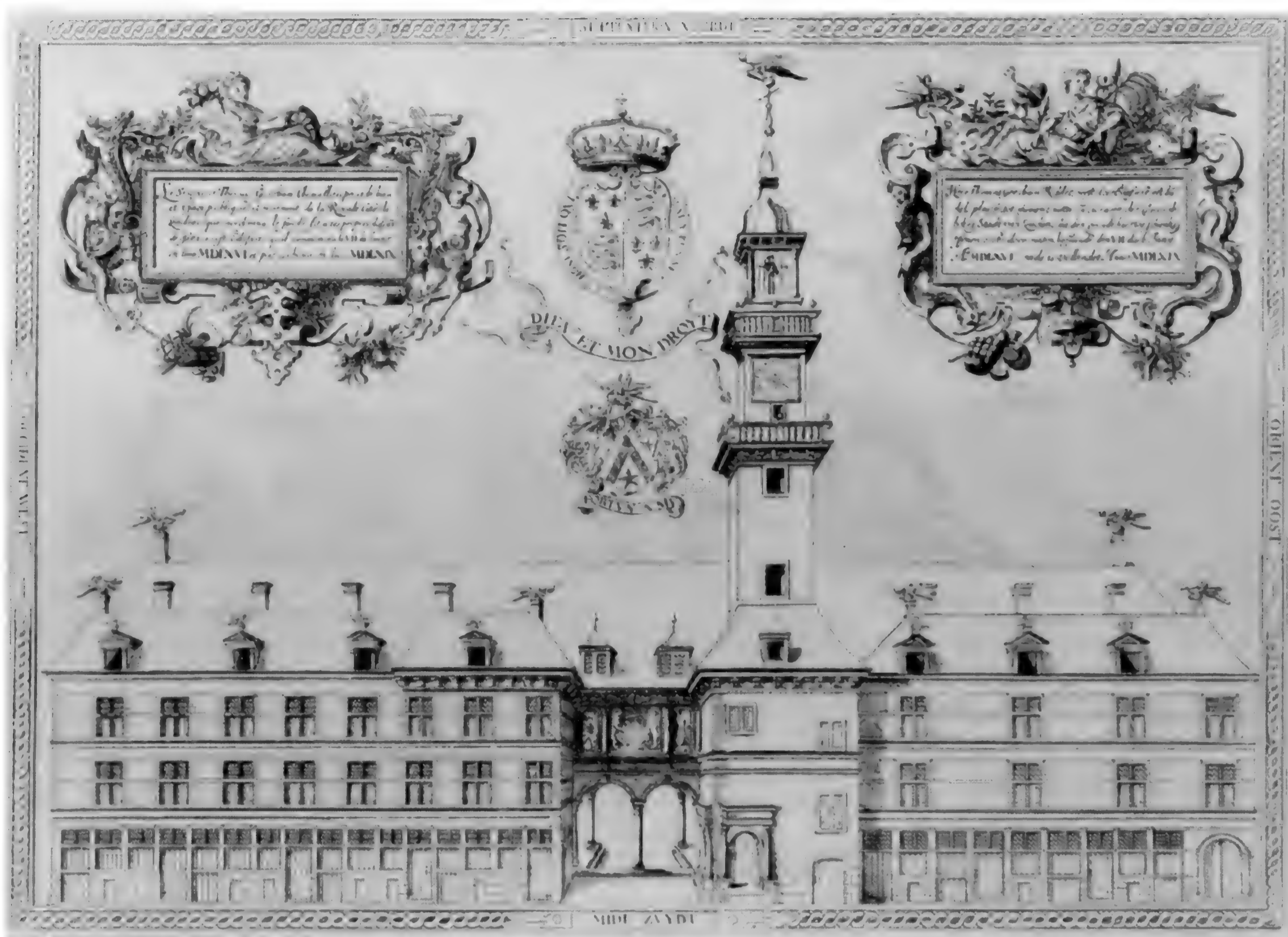


Plate 5a Frans Hogenberg, The exterior of the first Royal Exchange.
(Engraving, c.1570). Guildhall Library, Corporation of London.

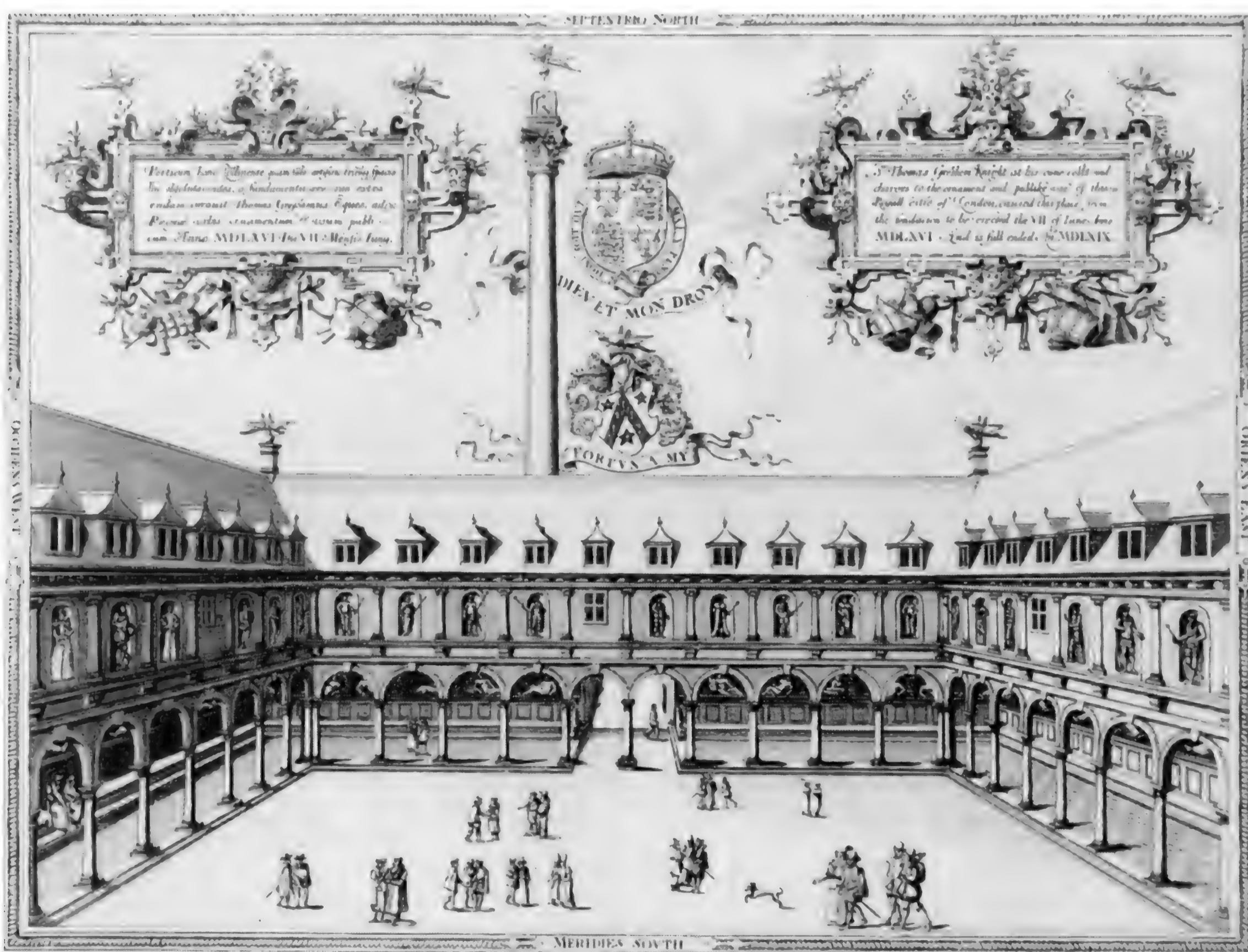


Plate 5b Frans Hogenberg, The interior of the first Royal Exchange.
(Engraving, c.1570). Guildhall Library, Corporation of London.



Plate 6 George Vertue, Pen and grey wash drawing, c.1740, of the first statue of Thomas Gresham made in 1622 by an unknown sculptor.
Guardian Royal Exchange Collection.



Plate 7 *Nicholas Stone, Statue of Elizabeth I (rejected in 1625 by the Gresham Committee). Guildhall Art Gallery, Corporation of London.*



Plate 8 Unknown sculptor, Statue of Charles I (rejected in 1626 by the Gresham Committee). Guildhall Art Gallery, Corporation of London.

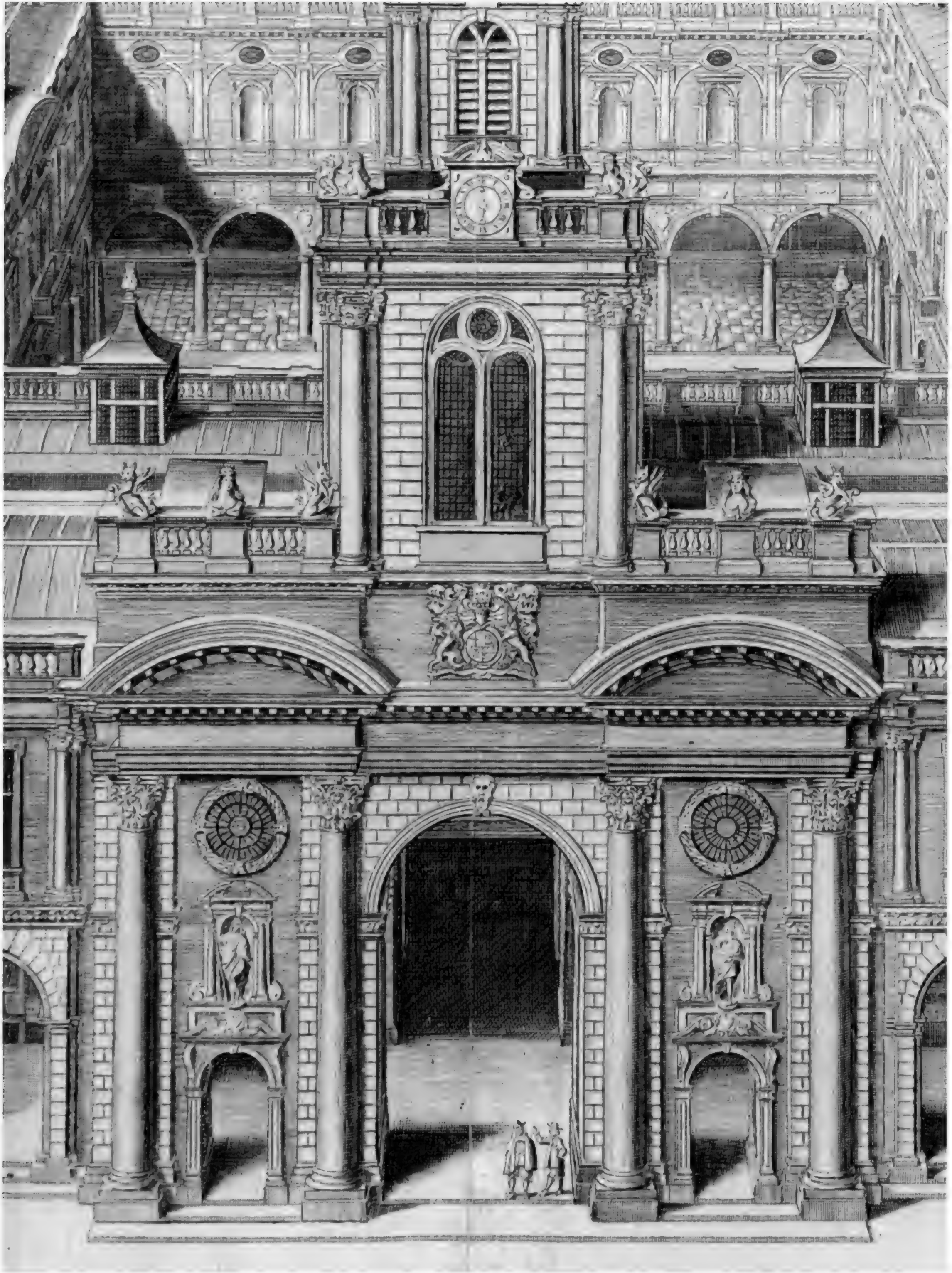


Plate 10 Robert White, The Cornhill façade of the second Royal Exchange, detail of frontispiece. (Engraving, 1671). Guildhall Library, Corporation of London.



Plate 11 John Bushnell, Statue of Charles I (from the Cornhill façade of the second Royal Exchange, at present in the Old Bailey), 1671. Guildhall Art Gallery, Corporation of London. Photo: Conway Library, Courtauld Institute of Art.



Plate 12 John Bushnell, Statue of Charles II (from the Cornhill façade of the second Royal Exchange, at present in the Old Bailey), 1671. Guildhall Art Gallery, Corporation of London. Photo: Conway Library, Courtauld Institute of Art.



Plate 13 Grinling Gibbons, Statue of Charles II (from the centre of the courtyard of the second Royal Exchange). Engraving by Peter Vandrebanc, 1684. *Guardian Royal Exchange Collection.*

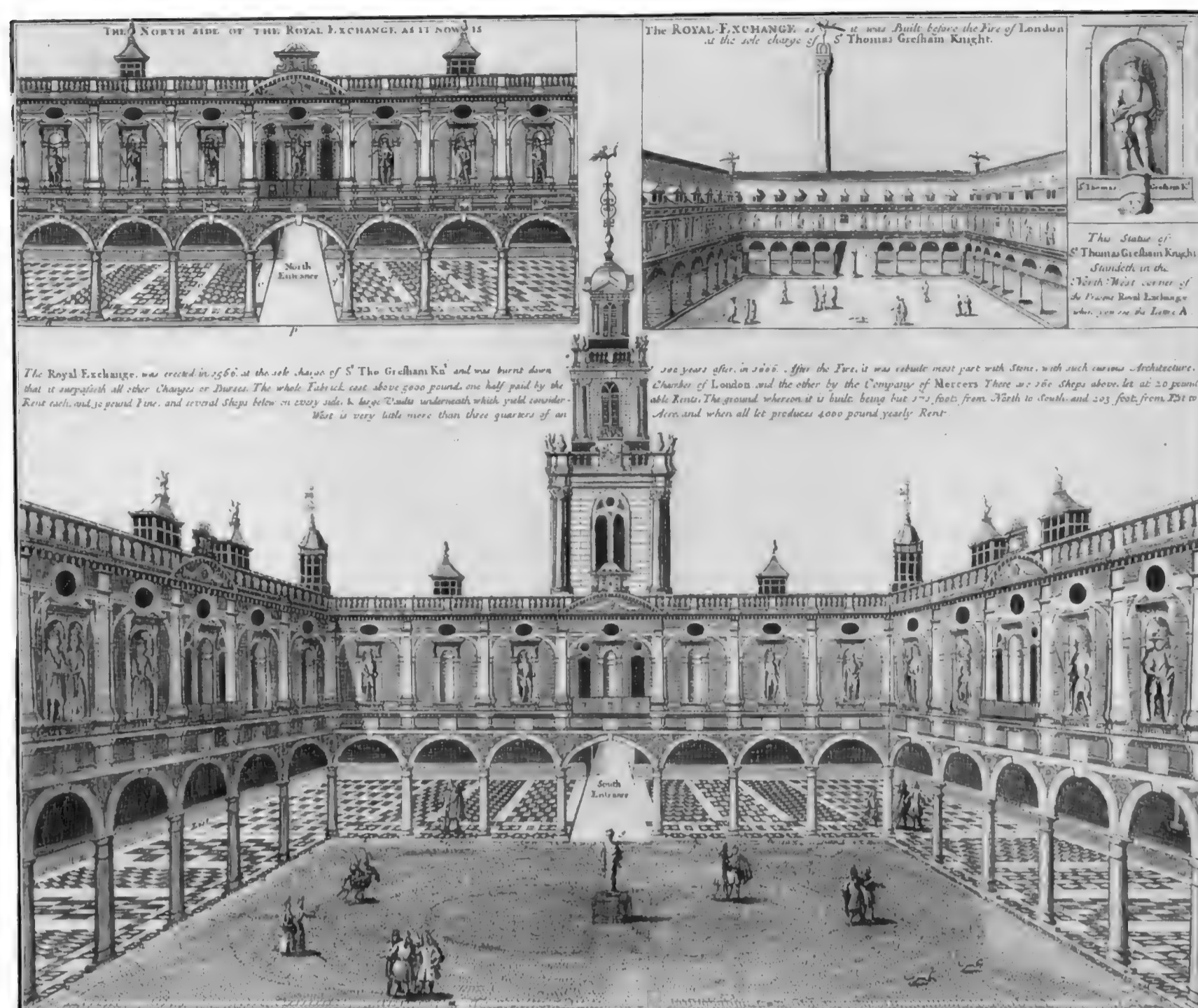


Plate 14 Sutton Nicholls, The courtyard of the second Royal Exchange. (Engraving, 1712). Guildhall Library, Corporation of London.



Plate 15a Attributed to Arnold Quellin, Model for the statue of Henry VIII (for the line of kings at the Second Royal Exchange), c.1685. The Governing Body of Christ Church, Oxford. Photo: Conway Library, Courtauld Institute of Art.

Plate 15b Attributed to Arnold Quellin, Model for the statue of Charles II (for the line of kings at the second Royal Exchange), c.1685. London, Sir John Soane Museum.



Plate 16a Attributed to Caius Gabriel Cibber, Model for the statue of Edward III (for the line of kings at the second Royal Exchange), 1667. London, Skinners' Company. Photo: Nick Gibson.



Plate 16b Attributed to Caius Gabriel Cibber, Model for the statue of Edward IV (for the line of kings at the second Royal Exchange), 1667. London, Ironmongers' Company. Photo: Nick Gibson.

cial difficulties, and occasionally catastrophes such as happened when in 1693 the Smyrna Fleet was largely sunk by the French and a number of underwriters were unable to meet their commitments.³⁷ Another problem was rogue brokers who were unable to get sufficient underwriters to complete their slips for granting insurance cover. These brokers would make a false entry on their slip, pocket the premium and hope for the best. In this event, when a ship was lost it could be that there were not enough underwriters to pay the claim in full: one well-known case of this happening early in the eighteenth century involved the ship *Vansittart*.³⁸ By 1717 merchants became dissatisfied with this system and sought for chartered insurance corporations as an alternative means of insurance. The merchants' complaints concerned the time it took for a policy to be completed, and the lack of information given to them about the persons who had agreed to underwrite the risk. Merchants' livelihoods depended upon their being able to receive their legitimate claims, and if underwriters failed the businesses of merchants failed too.

A subscription to raise £1m was opened in Mercers' Hall in 1717 for the purpose of insuring ships at sea.³⁹ It took until early 1718 for the sum to be raised, but the attempt to obtain a charter to sell insurance was unsuccessful. The Attorney General, Sir Edward Northey, and the Solicitor General, Sir William Thomson, were offered £1,000 in secret if the charter were arranged, and there is evidence of other corruption. Neither of these offices was remunerated by a salary, but fees and perquisites went to the office holders: in 1720 the office of Attorney General was reckoned to be worth £5,000 per annum.⁴⁰ However, the charter was still not obtained, and in 1718 the promoters purchased the shares of the Mines Royal and Mineral and Battery Works which provided them with two charters. Despite the fact that neither of these charters permitted the promoters to sell insurance, the Mines Royal began selling marine insurance policies from the Royal Exchange in 1719. This project eventually became Royal Exchange Assurance.

During the discussions about setting up insurance projects the new Attorney General, Nicholas Lechmere, was accused of accepting bribes by no less a figure than Sir William Thomson. This prompted the establishment of a parliamentary enquiry which resulted in the first parliamentary report

³⁷ Straus, *Lloyd's: Historical sketch*, p. 24.

³⁸ For this, see Gibb, *Lloyd's of London*, pp. 23-33; and Raynes, *History of British insurance*, pp. 94-5.

³⁹ Ibid., pp. 96-144; and see further Barry Supple, *The Royal Exchange Assurance* (Cambridge, 1970), pp. 12-34.

⁴⁰ For details of the positions of Attorney General and Solicitor General, see Anon., *The Present State of the British Court* (London, A. Bell at the Cross-Keys and Bible in Cornhill &c., 1720), p. 185.

on insurance.⁴¹ The seventy-four pages of this *Special Report* ... contain several petitions and much information about what was happening at the time. The result was that the allegations of corrupt and evil practices against Nicholas Lechmere were found to be malicious, false, scandalous and utterly groundless, and the report further stated that Nicholas Lechmere discharged his trust with honour and integrity. However, these events did not bring forth a charter, so the promoters decided to bribe the King openly. The King was offered £600,000 for two charters – that is, £300,000 each by Lord Onslow and by Lord Chetwynd, the leaders of the two main groups of promoters. Each promoter was to pay £100,000 before 22 July 1720 and the remainder in instalments of £50,000 up to April 1721. In addition there was to be a loan to the Government. The collapse of the South Sea Bubble speculation later in 1720 meant that the two insurance corporations were unable to pay more than £150,000, and they were allowed not to pay the rest. The *Six of Diamonds* in Thomas Bowles' pack of playing cards (Plate 3b) was occasioned by the Duchess of Marlborough's investment of £2,000 in Lord Onslow's company. She and the Duke of Marlborough made large sums of money by investing in bubble companies and shrewdly selling before the bubbles burst:

In vain are all Insurances, for Still
The Raging Winds, must answer Heaven's Will;
To what Wise purpose do we then Insure,
Since Some must Loose what e'er the Sea Devour.

Lord Onslow's Bubble was the Royal Exchange Assurance and Lord Chetwynd's Bubble became the London Assurance.

⁴¹ *The special report from the committee appointed to inquire into, and examine the several subscriptions for fisheries, insurances, annuities for Lives &c.* (London, Jacob Tonson &c, 1720).

Sculpture at the Royal Exchange

Katharine Gibson

The Royal Exchange was founded by Sir Thomas Gresham during the years 1564-68.¹ It was designed as a trading centre at the heart of the City, a place where merchants of many nationalities, handling commodities of many kinds, could transact their business. This included the exchange of credit, the negotiation of loans, the sharing of commercial risk, and the arrangement of transport and cargo space. It was both the origin of the Stock Exchange and England's first shopping mall. Stow tells us that there were 120 shops, or 'pawns', 'richly furnished with all sorts of the finest wares in the city',² selling such items as armour, drugs, books, glass, silk, lace, jewellery and furs. Two engravings by Frans Hogenberg are the earliest depictions of the original structure, from which it can be seen that Gresham intended to adorn the inside of the courtyard with a large amount of figural sculpture (Plate 5a & b). The site has never altered. It occupies the triangular block bounded by Threadneedle Street to the North and Cornhill to the South. It is close to the Mansion House and the Stock Exchange and next door to the Bank of England, and it looks straight up Cheapside to St. Paul's Cathedral.

Gresham went on to conceive of Gresham College, which was to be subsidized from the rents brought in from the Exchange. The full and satisfactory development of his two brain-children was, however, delayed by his death in 1579. His widow was left in charge and she would appear to have allowed the fabric to deteriorate; she was chiefly interested in collecting the rents. It was only after her death in 1596 that the responsibility for

¹ I would like to pay tribute to Ann Saunders, under whose editorship the book *The Royal Exchange* was published in 1997 by the London Topographical Society 152. Her chapters IV, XI, and XIV, on the founding and organization of the first and second Exchange buildings are the basis for much of the information I give. My essay, ch. XVI, 'The kingdom's marble chronicle, 1600-1690', (pp. 138-73), expands upon the topic discussed here, and Ingrid Roscoe's ch. XVII, 'The statues of sovereigns of England 1695-1831' (pp. 174-87), continues the study of sculpture.

² John Stow, *A survey of London written in the year 1598*, ed. W.J. Thoms (1842), p. 73.

the Exchange and Gresham College devolved upon the Corporation of London and upon the Mercers' Company, of which Gresham had been Master in 1569-70, 1573-74 and 1579. The Exchange would thereafter be run by the Joint Grand Gresham Committee, comprised of City aldermen and Mercers, in equal numbers, and the Corporation and the Mercers shared costs equally between them.

For all its national and international importance, fortune has not favoured Gresham's foundation. His original Bourse was completely destroyed in 1666, in the Great Fire. For the next two or three years, Gresham College, which was not damaged, became pivotal to the temporary administration of the City, acting as both Guildhall and Royal Exchange, as well as the headquarters of the Mercers' Company. In the ferment of rebuilding that followed, the Exchange was one of the first civic buildings to be finished, so important had it become.³ The second classical-baroque Exchange was completed by 1671, but it, in turn, came to grief in 1838 when fire again destroyed the building. The third Exchange is the temple-fronted Victorian edifice that we know today. Since it was given its royal epithet by Queen Elizabeth I in 1571, the Exchange has reflected the fluctuating attitudes of the British public towards the monarchy.

Gresham had lived for many years in the thriving port of Antwerp, and he constructed a functional building based on the Nieuwe Buers there.⁴ His London Exchange was also a three-storey structure, with covered arcades running round the inside of an open courtyard, and a clock tower to mark the hours for the business transactions taking place below. Hendryck van Paesschen, a Master Mason from Antwerp, designed the new building. Gresham irritated the London Company of Bricklayers by bringing in Flemish workmen, and importing ornamental stonework from Antwerp. A near-riot situation had to be defused by an agreement to share the work, but the end-product appeared very similar to its Antwerp predecessor.

The major difference was that Gresham wanted sculptures of thirty kings and queens of England to adorn the courtyard of his new building. Hogenberg, in c.1570, was probably illustrating Gresham's projected plans rather than actuality, because it was only when the Gresham Committee had gained control at the turn of the century that his wishes could be honoured. The first line of kings, however, was completely destroyed in the Great Fire, but the second Exchange, that rose like a phoenix from the ashes of its predecessor, was eventually re-embellished with similar royal figures in the

³ Christopher Wren, in his post-fire plan for the City which was never implemented, designed the Exchange to be the focal hub from which a wheel of new broad streets radiated.

⁴ The Nieuwe Buers, dating from 1531, can be picked out in Virgilius Bononiensis' bird's-eye view of Antwerp of 1565. The map is in the Plantin Moretus Museum, Antwerp, and an illustration can be found in colour plate II in *The Royal Exchange* op. cit.

1680s. When it came to replacing the statues, the Gresham Committee showed great concern that they should replicate the first line of kings. We can look, therefore, to what remains of the second line of kings as an indication of the first.

Hogenberg's print of the projected decoration of the quadrangle reveals female figures lounging in each bay under the arcades. What they were intended to represent – the virtues, say, or historical or mythological characters – is not known. The Exchange's first recorded statue was in fact a figure of Sir Thomas Gresham himself, installed in 1622.⁵ It can be seen in George Vertue's charming drawing, probably made in preparation for the engraved frontispiece to John Ward's *Lives of the Professors of Gresham College* of 1740 (Plate 6). It was carved by an unknown sculptor, and it was the only statue to survive the Great Fire, to be reinstalled in the second Exchange in its familiar niche under the north arcade⁶ – a fact that was regarded with superstitious pleasure by certain republicans.

The most eye-catching and dominant feature, however, was the line of Kings and Queens of England, standing in niches at first-floor level overlooking the courtyard. Such a large number of 'graven images' might be thought unusual in the sixteenth century when the image debate that followed the Reformation was raging furiously throughout Europe. Horrifying iconoclasm was occurring on both sides of the channel: Antwerp suffered a particularly dreadful bout in the very same years that the first bricks were rising at the Royal Exchange in London. The reign of Edward VI had seen the worst pillage here, but Elizabeth I had called a halt by forbidding any further defacing of antiquities and monuments. She declared that 'images of kings, princes or noble estates of this realm' should suffer no further damage.⁷ Calvin and Erasmus had seen no reason why portraits should not be permitted. Pictures of famous living people, or great characters from the past, could be justified as inspirational. Royal pantheons of this nature were not unprecedented in England. Richard II had decorated Westminster Hall with a dynastic series of thirteen kings placed round the walls at high level. Royal statues were also familiar in English cathedrals, where they were placed to intercede with the holy offices on behalf of the public. The choir screens at Canterbury and York, dividing off the nave, had life-size figures of

⁵ Mercers' Company Archives (MCA), Gresham Repertory I (1596–1625), f. 247, 18 April 1622; Gresham Accounts 1596–1625, f. 437 notes payment of the Mercers' moiety of £27 16s 10d.

⁶ This is recorded by Pepys on 5 September and Evelyn on 6 September 1666, and also by the Rev. Samuel Rolle in *The Burning of London in the Year 1666* (1667) Part III, Meditation LI, p. 186. The statue would appear to have survived at least until the 1790s (when it was drawn by John Carter, FSA in a pencil drawing now in the Guardian Royal Exchange Collection), but was probably lost in the 1838 fire.

⁷ *Tudor royal proclamations, vol. II: the later Tudors (1553–1587)* ed. P.L. Hughes and J.F. Larkin (New Haven and London, 1969), proclamation no. 469, p. 147.

the kings of England, and the west doors of Lincoln and Wells, Lichfield, Rochester and Exeter Cathedrals were flanked by standing or cross-legged monarchs who greeted the incoming congregation.

By including a historical line of English sovereigns, Gresham must have hoped to invest his new building with a similar, almost ecclesiastical, dignity. These English 'divinities' could intercede on behalf of the traders below with Heaven above. He thereby dedicated the Exchange to God and the Crown and to the welfare of the nation, and its mercantile purposes were thus given a strong moral justification. The line of kings would also prompt national pride, and convince foreign visitors that although the country had changed religion, the English had sound stability through the continuity in their rulers, stretching back before the Norman Conquest. In time, the sculptures took on a particular meaning, expressing the interdependency between the City and the monarchy. London's central position and its citizens' resources provided a power base for the sovereign, and the history of London in the seventeenth century is very much the history of the nation as a whole.

Some or all of the thirty niches created for the royal statues were still vacant in 1610, when Nicholas Leate, later Master of the Ironmongers, suggested that a financial penalty be imposed upon those guild members who wished to avoid their obligatory City duties, and that each fine should be put towards a statue. It was stipulated that the cost of each statue should not exceed 100 nobles, and that they were to be 'graven on wood, covered with lead, and then gilded and paynted in Oyle cullors'.⁸ Like church monuments, civic sculpture was commonly brightly coloured and gilded at the time, and town gates, bridges and city conduits were often decorated with colourful commemorative sculpture. In London, Ludgate had a statue of Elizabeth, and Aldgate and Aldersgate both had gilded figures of James I.

It was, however, a question of topical debate whether Italian Renaissance notions about the classical ideal and plain white marble sculpture should be imported from the Continent.⁹ Nicholas Stone (1586-1647) provided several statues for the Exchange in the 1620s, and he would later be appointed Master Mason to Charles I. He knew that in San Lorenzo in Florence, Michelangelo's commemorative figures to the Medici bore no resemblance to the men commemorated, and personified instead their

⁸ Corporation of London Record Office (CLRO) Court of Aldermen, Repertory 29, f. 224 printed in *Extracts from the records of the city of London ... respecting the Royal Exchange 1564-1825*.

⁹ D. Howarth, 'Charles I, sculpture and sculptors', *The late King's goods*, ed. A. Macgregor, (London and Oxford, 1989), p. 82; A. White, 'Nicholas Stone and early Stuart sculpture', *The Cambridge guide to the arts in Britain, Vol. IV: the seventeenth century*, ed. B. Ford (Cambridge, 1989), p. 267.

abstract virtues and strengths as heroes of classical antiquity.¹⁰ The Gresham Committee, however, clearly disliked the *avant-garde* and stuck obstinately to colours and gilding, despite changing fashions. They were equally hard to please over the questions of idealizing features so much that an individual became unrecognizable, and dressing figures in the correct period costume. These were to become regular disputes, and there are several examples of their reactionary tendencies.

In about 1625, Nicholas Stone executed four carvings of Edward V, Richard III, Henry VII and Elizabeth I.¹¹ The first three earned him £25 apiece, and were installed at the Exchange (and thus were all lost in 1666). The Gresham Committee, however, did not approve of the figure of Elizabeth, which had been 'made contrarie to the minde of this Court, and without their direccon'.¹² Wishing to symbolize the ethos of the Virgin Queen, Stone had produced a statue much more reminiscent of the banned Virgin Mary. Her elegant form, draped *all' antica*, with long flowing tresses under a virgin's veil and a small crown, can still be seen in the Guildhall Art Gallery (Plate 7). It was recognized as far too accomplished a piece to be discarded outright, so it was 'taken downe undefaced' and resited on Guildhall Gate. Stone received £30 for it.¹³ It is clearly a portrait of the beak-nosed Queen, but the veil and classical drapery, which are so finely executed, rendered her unrecognizable at a distance. Elizabeth had strictly controlled her image during her lifetime, and was universally known as a stiff, ageless figure, wearing stomacher and farthingale, with a red wig and an upstanding ruff. There could well have been a spirited argument among the members of the Gresham Committee over the rival merits of the real versus the ideal. The truthfulness of a likeness would become important to Puritan ideology – Oliver Cromwell would later insist upon being depicted with all his 'ruffness, pimples warts & everything as you see me, otherwise I never will pay a farthing for it'.¹⁴

Charles I in armour was duly added on his accession, but the first effigy by an unknown sculptor was again rejected by the Committee and sent over to the Guildhall, where it too remains to this day (Plate 8).¹⁵ The reasons for disapproval are nowhere spelled out. Perhaps the snake of Prudence slithering over the globe under his foot was too Platonic an allegory for the aldermen. The execution is not of the same quality as

¹⁰ Compare Stone's Holles monuments in Westminster Abbey.

¹¹ W.L. Spiers, 'The notebook & account book of Nicholas Stone', *Walpole Society* VII, (1918-19), pp. 57-8.

¹² CLRO Court of Aldermen, Repertory 37, f. 176b.

¹³ CLRO Court of Aldermen, Repertory 37, f. 208b. Spiers, op. cit.

¹⁴ *Vertue notebooks*, I, *Walpole Society* XVIII, (1929-30), p. 91.

¹⁵ The figures of Elizabeth and Charles I will remain in storage until the Guildhall Art Gallery re-opens in summer 1999.

Stone's Elizabeth. The detailing of fur, lace, armour, and jewels is painstaking, but the portrait is stereotyped and the head and crown curiously inept. The acceptable alternative by Andreas Kearne, Stone's brother-in-law, was finally set up in April 1629, but there is no information as to how it differed from the reject.¹⁶ Both the Guildhall's figures were recently examined and revealed vestigial remains of 'tinted limewashes': Elizabeth's face was at some time painted a dull pink, and Charles I once wore red breeches.¹⁷

Wenceslas Hollar published a fine engraving of the *Byrsa Londinensis*, in 1644, with angels in the sky trumpeting its fame, and the milling concourse of merchants below (plate 9).¹⁸ Foreigners in their differing national costumes can be spied among the busy crowd. The sovereigns stood in chronological order round the courtyard, and carried orbs and sceptres.¹⁹ All wore crowns except for the youthful Edward V, whose crown is suspended above his head. Hollar must have had his back to the figures of Edward the Confessor round to Stephen, which stood under the tower. The nearest statue on the left is Henry II, holding his Plantagenet shield with its heraldic lions. Beneath the foot of the next king a lion slumbers, identifying Richard the Lionheart, and the sequence continues round to Charles I standing on the right.

By 1644, the date of Hollar's engraving, civil war had split the country. Hollar was a devoted royalist who was forced into exile that very year. Whether published at home or in Antwerp, this print conveyed a clear polemical message reminding the City of its historical links with, and responsibilities towards, the monarchy. But public statues have always attracted unwelcome attention in times of unrest. After Charles I's execution in 1649, 'Un-kingship was proclaimed' (to use John Evelyn's words of 30 May 1649). In December 1650, the Council of State ordered that any 'picture of ye late king', and any crest with the royal arms, was to be removed from City churches, 'Comon halls of Companies, & other publique places of meeting'.²⁰ (The figure of Charles I rejected by the Gresham Committee, which was by then standing on the Guildhall Chapel façade, was taken down and reinstated at the Restoration.) The Council of State stipulated, in particular, that the Exchange's statue of the King should have 'ye head ...

¹⁶ CLRO Court of Aldermen, Repertory 43, f. 152. 30 April 1629. Kearne's dates are unknown.

¹⁷ Helen Hughes, *Historic paint research report* commissioned by Nimbus Conservation, 1992, states that such limewashes are notoriously difficult to date.

¹⁸ R. Pennington, *A descriptive catalogue of the etched work of Wenceslas Hollar 1607-1677* (Cambridge, 1982), p. 182, no. 1036i.

¹⁹ Every king is listed, together with his inscription giving the number of years, months and days that he had reigned, in *The journal of William Schellinks' travels in England 1661-1663*, trans. and ed. M. Exwood and H. L. Lehmann, Camden Fifth Series I (1993), p. 52.

²⁰ Ironmongers' Court Minutes, Guildhall M16,967/5, f. 101. 17 December 1650.

broaken off, and ye sceptre broaken out of his hand. And this inscription put upp by it, Exit Tyrannus Regum Ultimus.'²¹ The Gresham Committee were clearly reluctant to deface their statue. The first entry on the subject in their Repertory is slashed through with a pen-stroke. Having obeyed and desecrated the figure, they decided it looked unsightly and they should remove 'what is remayning of ye statue'. Finally they required the Town Clerk to sign a certificate to the fact that they had been obeying an order of Parliament.²² After the Great Fire in 1666, a Latin inscription expressing their regret for past deeds was added under the replacement figure of Charles I, to the effect that the King had been twice martyred - *Bis Martyris (in Corpore & Effigie)*.²³

During the Commonwealth, disaffection was with Charles I only, and the figures of the other sovereigns were maintained.²⁴ The first movement in 1656 towards persuading Oliver Cromwell to take the Crown, came from the City, and it is intriguing to discover that a picture of the Protector was hung up in the Exchange,²⁵ although there is no proof that a statue was ever installed. With the increasing certainty of the restitution of the monarchy early in 1660, there was a sudden revival in the importance attached to 'The Kingdom's Marble Chronicle', as the royal statues at the Exchange were called.²⁶ The City of London gave generously towards the subsidy sent to Breda to bring Charles II home, and Pepys wrote that the statues of the two kings, Charles I and II, were to be placed upon the Exchange. The figure of Charles I held a shield with the inscription 'MAGNA CHARTA', and Charles II's shield read 'AMNESTIA: OBLIVION', pointedly expressing the reciprocal conditions of the Restoration.²⁷ These two stood in place for only six years until the Great Fire.

Gresham's wishes for royal statues had not been honoured until long after the Tudors had given way to the Stuarts. Now after the Great Fire, there

²¹ CLRO Court of Aldermen, Repertory 60 (1949-50), f. 212.

²² CLRO Court of Aldermen, Repertory 60 (1949-50) ff. 219-220v.

²³ *Wright's public transactions, (a compendious view of the late tumults & troubles in this kingdom by way of annals ... by J.W. Esq.)* (1685) p. 169.

²⁴ MCA, Gresham Repertory 1629-1669, f. 170: payment to M. Derby in 1657 for 'brushing washing and clensing' the statues.

²⁵ J. Friswell, 'Curious epigrams on Oliver Cromwell', *Notes and Queries* I. S. iii, no. 87 (June 28, 1851), p. 516, states that a poem was pinned up 'Under Gen. Cromwell's Picture, hung up in the Royal Exchange', which began 'Ascend ye Throne Greate Captaine ...' and ended 'God save ye King!'. Andrew Marvell also wrote a Latin couplet, *In Effigiem Oliveri Cromwell* (see his *Complete works*, ed. A.B. Grosart, Vol. I Verse [1872], p. 415).

²⁶ 'The conflagration of London poetically delineated' by Simon Ford, printed in *London in flames London in glory: poems on the fire and rebuilding of London 1666-1709*, ed. R.A. Aubin (New Brunswick, 1943), p. 13, l. 265.

²⁷ J. Heath, *The glories and magnificent triumphs of the blessed restitution of his sacred majesty King Charles II* (1662), pp. 165-6.

was a new spirit of renaissance, and the City of London teemed with opportunities for masons and sculptors. The English sculptor, John Bushnell (d. 1701) was paid £75 in 1671 for making a second statue of Thomas Gresham, which was placed 'over the South Entrance' and still survives.²⁸ The Cornhill façade of the new building was completed the same year. The frontispiece took the shape of a triumphal arch and it was symptomatic of the Committee's eagerness to renew its allegiance to the Crown, that they decorated it with the figures of Charles the Martyr and Charles II.²⁹ They can be seen in a detail of the inaugural engraving by Robert White of 1671 (Plate 10), together with the six dragons and four maidenheads, made by the almost unknown sculptor, John Bullimore, which are visible around the parapets of the central tower.³⁰ The dragon, otherwise known as a griffin or wyvern, had only recently become the symbol of the City.³¹ The maidenhead was the Mercers' emblem; both components of the Gresham Committee were therefore prominently represented.

John Bushnell was also responsible for carving the two royal figures which are surprising survivals of the English baroque (Plates 11 and 12).³² He had recently visited Italy and gained some knowledge of Bernini's work, and this expertise is apparent in the strong diagonals, complicated drapery, and textural finesse. Bushnell was a vain and self-important man who managed to set the Gresham Committee against him. There is evidence that he began on the line of kings for the courtyard, but although six figures were nearly finished, for some reason they were not acceptable. They are described in a contemporary poem as 'Caesars', i.e. statues in Roman dress.³³ My conclusion is that the Committee took exception to the anachronistic mixture of the contemporary

²⁸ MCA, Gresham Account Books, 4 November 1671; Mercers' Rentwarden's Accounts 1658-75, f. 25.

²⁹ K. Esdaile, 'John Bushnell sculptor', *Walpole Society* XV (1927), pp. 31-2 and note 1. Rescued undamaged in 1838, together with Bushnell's figure of Gresham, they were housed at Gresham College until 1912 when that building was demolished. Three years later they were transferred to the antechamber of the Central Criminal Court at the Old Bailey where they remain to this day. They belong to the Corporation of London.

³⁰ Bullimore's dates are unknown. He was paid £15 for this work 'by appointment of Mr. Cartwright', the mason who supervised the building of the Cornhill facade. CLRO Gresham Accounts, Misc. MSS 150.5, sanctioned for payment 21 September 1677.

³¹ J. Dallas, 'The city of London and its dragons', *British Archaeological Association Journal* 2nd series, 19 (1913), pp. 88-102.

³² MCA, Gresham Repertory 1669-76, 25 January 1672/3, payment to Thomas Cartwright who must again have sub-contracted the work to Bushnell, whose sons told Vertue that their father was responsible for the figures (*Vertue notebooks* II, *Walpole Society* XX [1931-32], p. 9).

³³ Theophilus Philalethes, 'Great Britain's glory or a brief description of the present state, splendor and magnificence of the Royal Exchange', ll. 624-6, printed in *London in flames London in glory*, p. 189ff. Vertue saw the abandoned figures in the late sculptor's house in 1725. *Vertue notebooks* II, p. 8.

and the antique which the Cornhill figures represented. Charles II, for instance, is dressed like a Roman imperial hero, but also wears a periwig, and the medieval Garter, pointlessly, round his bare left leg.

The anachronisms were removed just over a decade later in a second statue of Charles II, this time by Grinling Gibbons (1648–1721), the King's Surveyor and Repairer of Carved Work at Windsor.³⁴ It was installed by the Merchant Adventurers in the centre of the quadrangle.³⁵ It is as 'archaeologically pure' as could be managed in the seventeenth century. Gibbons' king weathered away, but its appearance is known from a huge engraving by Peter Vandrebanc (Plate 13).³⁶ It was very similar to the surviving bronze of Charles II, also by Gibbons, which stands in Figure Court at the Royal Hospital, Chelsea. Gibbons' stone figure was one of three statues of Charles II to reign together over the second Exchange for the next hundred years. The third would be in the line of kings round the inside of the courtyard.

A long hiatus was caused by the trouble with John Bushnell's six 'Caesars' that had been destined for the line of kings, and there was further delay because of a national controversy which occurred in the early 1680s, known as the *Quo Warranto* affair. By removing the charters of town corporations and guilds right across the country in an effort to pack their membership with his supporters, Charles II had set many against him. The London Livery Companies were grudgingly brought back into line by a Mayoral Precept, issued in 1684, requiring each guild to supply a royal statue for the Exchange.³⁷ The replacement statues were to be 'made in proper habitts and as near as can be remembred to what they were in before the great fire'.³⁸ Two torsos remain to show that the medieval figures, particularly, may have been deliberately rudimentary in quality in an attempt to appear archaic.³⁹

³⁴ G. Beard, *The work of Grinling Gibbons* (London, 1989), p. 12.

³⁵ *Wright's public transactions*, p. 198. Aurelian Cook, *Titus Britannicus: an essay of history royal in the life & reign of his late sacred Majesty Charles II, of ever blessed and Immortal Memory* (1685), p. 464. E. Hatton, *New view of London or an ample account of that city* (1708), p. 616. See also *The diaries and papers of Sir Edward Dering, Second Baronet, 1644–1684*, ed. M.F. Bond (1976), p. 144.

³⁶ Examples are relatively common and can be seen in the British Museum, Windsor Castle Royal Library, Guildhall Library, the Ashmolean Museum and the Guardian Royal Exchange Collection.

³⁷ Guildhall MS 17,087. CLRO Court of Aldermen Repertory 90, ff. 3–4, 2 November 1684, orders that one print of the Precept should be delivered to each of the Livery Companies.

³⁸ This phrase occurs in CLRO Court of Aldermen Repertory 90, f. 15b. in relation to the Armourers' figure of Henry VI, but it is reiterated almost verbatim throughout the directions to the other guilds.

³⁹ The torsos were acquired by the builder John Mowlem in the sale held after the fire in 1838 by Joseph Pullen & Son (Guildhall Library Pamphlet 1620). They now stand in the gardens of Purbeck House Hotel, Swanage. Photographs can be seen in *Royal Commission on historical monuments, South-East Dorset II*, pp. 295–6.

The antiquary John Carter made a number of small drawings of some of the Tudors and Stuarts before the second Exchange was destroyed, from which we can see that authenticity of dress, after all the problems in the past, had been a high priority.⁴⁰

William and Mary, and Queen Anne, followed by the four Georges, were added on their accessions, but only after they each had earned the City's approval.⁴¹ Sutton Nicholls' multiple engraving of 1712 names the fourteen kings and queens installed to date and shows Gibbons' figure of Charles II in the centre of the courtyard (Plate 14). For the third incarnation of the Exchange, the line of kings was no longer deemed necessary. The only sovereigns to feature still are Queen Elizabeth, King Charles II and Queen Victoria, during whose reigns the successive buildings had been erected.

Returning to the 1680s, the replacement figures for the line of kings in the second Exchange had been faithfully copied, with their polychroming and gilding, from what could be remembered of the first Exchange's line of kings. Carter's unmistakable drawing of Henry VIII is closely related to a lead maquette, probably by Arnold Quellin (1653-86), which now stands in the Library at Christ Church, Oxford (Plate 15a). The Haberdashers' Company, who paid Quellin for the large-scale statue of Henry VIII at the Exchange, had a model made for them, and I think this little figure was made to do double duty when the Dean of Christ Church, at much the same time, was exploring the possibilities of a statue of Henry VIII for Tom Tower.⁴² Also frequently attributed to Quellin is a fine terracotta model of Charles II in Garter robes, now in the Sir John Soane Museum (15b). The full-size figure, paid for by the Grocers' Company, joined the line of kings only after the King's death in 1685.⁴³ Because the terracotta was acquired by Soane before the Exchange was demolished in 1838, it could be identified with the bigger work still *in situ*.⁴⁴

Two more models date from earlier still, from immediately after the Great Fire. They were fashioned by the Danish sculptor, Caius Gabriel Cibber (1630-1700). In 1667 he was appointed Royal Sculptor.⁴⁵ Charles II saw and approved some fine models made by him, and recommended them to the Gresham Committee at this time.⁴⁶ The Skinners' Company still possess

⁴⁰ Carter's drawings belong to the Guardian Royal Exchange Collection. They are illustrated in *The Royal Exchange*, op. cit., pp. 162, 163, 178.

⁴¹ Roscoe, in *The Royal Exchange*, op. cit., p. 174.

⁴² Guildhall MS 15,842/3, Haberdashers' Court of Assistants Minute Books, 11 July 1685. *Wren Society* V, p. 22, Letter no. 7.

⁴³ Grocers' Company, Accounts 1685-6.

⁴⁴ Sir John Summerson noted that it was bought at the sale of Richard Cosway's possessions held 22 May 1821 (Lot 30).

⁴⁵ Cibber's appointment is dated 20 June 1667 in the Public Record Office, LC3/25, p. 113, confirmed LC3/26, p. 149.

⁴⁶ Mercers' Company, Gresham Repertory 1629-69, f. 315.

a polychrome maquette of Edward III who had earned the title of 'The Father of English Commerce' (Plate 16a). The Ironmongers' Company have another of Edward IV who had become known as 'The Merchant King' (Plate 16b). Edward III is dressed in blue and silver, and Edward IV in scarlet and gold. Neither of the large-scale sculptures was put in place until much later, in 1685,⁴⁷ but Cibber had lived in England since well before the Restoration and knew the Royal Exchange before its destruction in 1666. Because they were deliberately fashioned upon the figures in the earlier line of kings, these two brightly coloured statuettes bring one as close as one can get to Gresham's original intentions.

⁴⁷ Skinners' Company Court Minutes, ff.397, 401, 414, 422 and 424. The Skinners' model was provided by 'one Gabriel Sibart a Stone Cutter in St. James's', but the final carving was made by Edward Pierce. In the case of the Edward IV, the large-scale work was carved by Thomas Cartwright. Ironmongers' Court Minutes, Guildhall MS 16,967/6, 5 December 1684 and 13 January 1685; MS 16,967/7, ff. 3-4,7 (April 1685); MS 16,988, Ironmongers' Accounts 1671-87, f. 403 (May 1685).

Civic rhetoric, 1560-1640

Lynette Hunter

As many of the articles in this volume attest, Thomas Gresham was one of a new group of people who in the Tudor period were defining for themselves, outside the court, a social place of enormous respect and power. Their actions and behaviour are central to the debate raging all through the period concerning gentility and nobility by birth or by actions – a debate that set the terms for the final disruption of the concept of divine power, laid out the vocabulary for the Civil War of the seventeenth century, and formed the basis for the constitution of a ‘class’ called the bourgeoisie who became the citizens of the liberal social contract.

The discussion of appropriate behaviour and communication, which was emerging in the late sixteenth century, was embedded in the teaching of rhetoric. It has, however, been neglected by historians of rhetoric who still, with some few exceptions, make the story of rhetoric focus implicitly on the separation made by Peter Ramus between rhetoric and logic.¹ Some studies pursue the separation into a discussion of logic as opposed to eloquence, and are concerned with rhetoric as deceit. Others pursue the separation into a discussion of logic as opposed to the rhetoric of poetry with all its ambiguities.² Both of these elements are allied closely to court poetry, and in each case the implication is that rhetoric as a field for dealing with the probable, rather than the certainties of logic and the ambiguities of poetics, simply disappears. This paper will argue that rhetoric as a methodology and philosophy for dealing with the probable is developed quite firmly into *sermo*, or conversational, rhetoric. My argument here is part of a longer work that addresses the issues of courtly, civic, mercantile and professional, familial, personal and psychological behaviour in the sixteenth to

¹ See A. Grafton and L. Jardine, *From humanism to the humanities* (Cambridge, 1986), for an alternative view; see also J. S. Freedman, ‘The diffusion of the writings of Petrus Ramus in Central Europe’, *Renaissance Quarterly* 46 (1993), pp. 98-152.

² For an overview of early critical response, see J. J. Murphy (ed.), *Renaissance rhetoric* (New York, 1981), and *ibid.*, *Renaissance eloquence* (London, 1983).

seventeenth centuries. Here I focus on the civic rhetoric that was elaborated in the period 1580 to 1620.

First a short background in rhetorical issues. At the centre of the debate about behaviour is the issue of deceit, particularly of how you know deceit when it is happening. In schematic terms this issue is mapped in the movement from Thomas Wilson's *Arte of Rhetoric* (1553) which portrays the courtier as a 'humanist' and therefore good, to George Puttenham's *The Arte of English Poesie* (1589) which portrays the courtier as displaying himself and radically ambivalent. Roughly between the two comes Thomas Hoby's translation of Castiglione's *The Courtier* (1561) which discusses the complex web of being noble by birth and how one displays this nobility in order to insist on a hierarchy of power. Most critics and historians have treated this question as one of ambivalence.³ And, since a fundamental part of rhetoric is ethos, or the presentation of the speaker, if ethos becomes inevitably untrustworthy and ambivalent, then rhetoric necessarily moves to the popular definition we think of today, rhetoric as an unscrupulous mode of communication. However, in all the major writings on rhetoric from Plato onward, rhetoric is not defined in this way alone, but also as at the heart of moral philosophy. So, why does this moral activity 'disappear' from rhetoric in the seventeenth century, especially in the light of the fifteenth- to sixteenth-century humanist revisioning of rhetoric precisely as moral training?

Most work on the issue has looked at the exclusive education system for the aristocratic and wealthy that frequently acted as a precursor to court attendance and public display at a time when display was becoming part of the definition of the subject in the early modern nation (later to become the subject within the ideology of nation states). More recently critics have begun to look at the extensive literature on personal behaviour explicitly in the non-court areas: that of preachers, merchants, doctors, and lawyers.⁴ My own work has been focusing on the more general categories of civic and domestic life.⁵ In the history of courtiership, Frank Whigham, in particular,

³ For example, on stance perception Lawrence Green, 'Stance perception in sixteenth-century ethical discourse', in V. Aarons and W. Salomon (eds), *Rhetoric and ethics: historical and theoretical perspectives* (Lewiston, Queenston and Lampeter, 1992), pp. 59-80; on self-fashioning, Stephen Greenblatt, *Renaissance self-fashioning: from More to Shakespeare* (London, 1980); and on the social construction of identity, Frank Whigham, *Ambition and privilege: the social tropes of Elizabethan courtesy theory* (London, 1984). See also S. May, *The Elizabethan courtier* (Columbia, 1991).

⁴ For example, Douglas Bruster, *Drama and the market in the age of Shakespeare* (Cambridge, 1992); Richard Halpern, *The poetics of primitive accumulation* (London, 1991); and Ceri Sullivan, 'Mercantile Rhetoric', paper given to the International Society for the History of Rhetoric day conference, Leeds, March 1997.

⁵ These categories are firmly in the vernacular. See W. Boutcher, 'Vernacular humanism in the sixteenth century', in J. Kraye, (ed.), *The Cambridge companion to Renaissance human-*

allies the reception of Italian civic humanism with the development of courtly style. He looks at Castiglione, della Casa, Guazzo and others, as offering versions of definition for the courtier and differing only in whether you think they are exclusionary or not – in other words either there to keep other groups of people out of the nobility, or there to be used by others precisely to get into the ranks of the courtly.⁶

My reading differs, especially with regard to Guazzo who, it seems to me, is suggesting a different kind of rhetoric for the person outside the court. This rhetoric of civic humanism follows the trend of increasingly using the word 'civil' to distinguish not the regal from the court,⁷ but the court from the city. In the process the word takes upon itself the role of arbiter and descriptor of the civic and economic realm, economics referring – at least until 1640 – to the subsistence financing of the household. I read Pettie's translation of Guazzo's *Civile Conversation* (1581) not as a continuation of the Castiglione/Machiavelli line on courtly self-display, but precisely as a debate about how to distinguish that behaviour from other kinds of behaviour that are more trustworthy and less competitive. The word 'conversation' is allied to *sermo* rhetoric⁸ – elaborated on by Cicero not in the *Orator* but in the *De Amicitia* on friendship. Possibly more important, is Erasmus's translation from the Epistle of St John: In the beginning was 'logos' not as *verbum*, as in many bibles of the time, but as *sermo* or conversation,⁹ recalling the Greek understanding of logos as 'proportionality' not a narrow and reductive mode of the rational.¹⁰ 'Conversation' marks the travel of trustworthy rhetoric from the civil court of the 1560s, first into the civic and economic – the realms of the city and household by 1600 – then into a more restricted sense of neighbourliness and the curtailed private family by 1630, and finally, although quite outside the scope of this paper, into the

ism (Cambridge, 1996); J. Martindale, *English humanism: Wyatt to Cowley* (London, 1985); and M. McClintock, 'The Reformation and the emergence of English vernacular rhetoric in mid sixteenth-century England', a paper delivered to the International Society for the History of Rhetoric, 1997.

⁶ See also J. Lievsay, *Stefano Guazzo and the English Renaissance, 1575-1675* (Chapel Hill, 1961), and W. Rebhorn, 'Baldesar Castiglione, Thomas Wilson, and the courtly body of Renaissance rhetoric', *Rhetorica* 9, 3, (1991), pp. 207-26.

⁷ See Thomas Hoby, *The Book of the Courtier* (London: David Nutt, 1561), and Richard Mulcaster, *A learned commendation of the politique lawes of England*, trans. of Fortescue (London: Richard Tottill, 1567).

⁸ J. Tinkler, 'Renaissance humanism and the genera eloquentiae', *Rhetorica* 5, 3, (1987), pp. 279-309.

⁹ See Richard Cunningham, 'Rhetorical or scientific inconsistency? A gap between programme and practice in early modern science', conference paper to the International Society for the History of Rhetoric, Saskatoon, 1997.

¹⁰ See C.J. Swearingen, *Rhetoric and irony: western literacy and western lies* (Oxford, 1991).

intimacy of religious behaviour,¹¹ the construction of spiritual virtue and the conversation of women. Interestingly 'conversation' became a technical rhetorical term for women's speech in the seventeenth century,¹² and is found well into the eighteenth in for example the work of David Hume.¹³

What is this kind of rhetoric, this code of behaviour that 'conversation' signifies or gestures toward? The key areas under discussion in the 1560-1640 period are behaviour in personal, familial, civic and government locations. They call at each respective jointure on moral, economic, and political or ethical issues. Commentaries from the period discuss the way that behaviour offers evidence in both looks and speech for the 'true' nature of an individual. In the early years of Elizabeth's reign there is extensive discussion on judging people by their looks and bodily gestures, even by their use of force – for if you use force you must believe you are right and therefore, with the rhetorical impulse to assertive persuasion, you *are* right: might is right. This is despite many commentaries to the contrary which argue that one only uses force if all else fails, and that force is therefore an indication of weakness. Thomas Newton's translation of Lemnius' *Touchstone of Complexions* (1576) observes on its title-page that the state, habit, disposition and constitution of the body are all indicative of inclinations, affections, motions and desires. In 1580 Thomas Blundeville notes that virtue and an honest disposition are distinguished from malicious defrauding by the 'Body'.¹⁴

But during the period up to 1615 a major shift toward speech and away from looks occurs, that is part of a move to democratic principles. It is also anti-militaristic, arguing that war should only happen on behalf of the nation, and it is universalizing. A great deal that is said about *sermo* rhetoric is based on the same arguments. The two ways of assessing behaviour are connected to two systems of rhetoric. One, gesture, is essential to the orator and courtier, and is illustrated in the voluminous and slightly later *Chirologia* (1644) by Bulwer. Yet despite the recent incessant talk about 'body-language', people in most western cultures are not trained formally in gesture. The other, speech, is more familiar to us. It is worth noting here the trope of the eye and the soul, where we look into the soul of another, or their eyes

¹¹ For this, see George Fox, *The Christian Principle and Peaceable Conversation of the People (of God) called Quakers with respect to the King and Government once more asserted* (London [?], 1685).

¹² See, for example, the letters of Dorothy Moore, in the Hartlib Archive, University of Sheffield: Lynette Hunter, *The letters of Dorothy Moore* (forthcoming: Amsterdam, 1999).

¹³ For this, see Nancy Struever with B. Vickers, *Rhetoric and the pursuit of truth: language change in the seventeenth and eighteenth centuries* (Los Angeles, 1985).

¹⁴ Thomas Blundeville, *Three Morall Treatises*, trans. of Plutarch (London: Henry Denham, 1580), H5v-H6v.

'pearce' ours, in a gazing that is not necessarily an interaction.¹⁵ The parallel trope of the tongue and heart has a different emphasis, for the originator/speaker displays his or her heart and the audience hears and recognizes it in a potentially more engaged manner. The two systems are important to the development of conversational or *sermo* rhetoric, which is allied with *negotio* and interaction, and is distinguished, as we shall see, from eloquence, fashion and the gaze. Certainly the two approaches were an issue debated at the time. Puttenham, among others,¹⁶ distinguishes between physiognomy as the clue to manners through the eyes, and writing or speech as the clue to manners through language; and he goes on to claim the latter as the appropriate path.

A RHETORIC STORY FOR CIVIC DISCOURSE

Sixteenth- to seventeenth-century rhetoric is aware of three fields, not just the split between logic and rhetoric as discourses about certain and uncertain things respectively. The three fields are roughly equivalent to those in classical rhetoric of the epideictic, the deliberative or demonstrative, and the judicial. But in the many vernacular texts concerned with civic life they are shifted into (for example) William Fulwood's terms of Myth, Gravity and Doctrine, or T. B.'s translation of Johannes Sturm's work on oratory, which offers the terms Pathetic, Moral and Proportional.¹⁷ Rhetoric comprehends that all logics have their own rhetoric and even rhetorics have stances. Rhetoric also thinks of uncertain things as probable and as plausible: in this, as Agricola attempted to remind people, it lays claim to dialectics.¹⁸ The plausible indeed is the partner of the certain, because one person's certainty is another's arbitrary choice; whereas in the probable all grounds for knowing are first to be discussed and agreed upon. Sixteenth- and seventeenth-century rhetorics debate the issues between these kinds of uncertainty at length, and the plenitude of that word 'logos' which Erasmus elaborates into signifying '*sermo, verbum, oratio, ratio, sapientia, and computus*'¹⁹, indicates that the debate is not a binary one but is highly complex.

¹⁵ Although the eye can act as a Neo-platonic hook, according to Ficino; see for example, Fleur Rothschild, *Recovering Romeo and Juliet*, PhD, University of London (1987).

¹⁶ George Puttenham, *The Arte of English Poesie* (London: Richard Field, 1589); and see also Thomas Wright, *The Passions of the Minde* (London: V. S. for W. B., 1601).

¹⁷ W. Fulwood, *The Enimie of Idlenesse* (London: Henry Bynneman for Leonard Meylard, 1568); T. B., *A Ritch Storehouse or Treasurie for Nobilitye and Gentlemen*, trans. Johannes Sturm (London: Henrie Denham, 1570).

¹⁸ L. Hunter, 'Watson and McLuhan's From cliché to archetype', in L. Hunter (ed.), *Topos, commonplace and cliché: toward an understanding of analogical reasoning* (London, 1991), pp. 199-227.

¹⁹ Quoted by Richard Cunningham in 'Rhetorical or scientific inconsistency? A gap between programme and practice in early Modern Science', a paper delivered to the biennial

Arguably the most contentious of the three areas of rhetoric is the deliberative or demonstrative – and particularly the deliberative, if we take Daie's distinction between the two,²⁰ because the demonstrative is closer to description and therefore less uncertain. The epideictic is largely without pragmatic aim, and the judicial is focused on certainties and evidence. Those middle terms found in Fulwood and Sturm, of Gravity and the Moral, and which pertain to the deliberative and demonstrative, emphasize the importance of knowing how or whether you are being deceived, or if the speaker is trustworthy. They are completely dependent on ethos, as was the earliest printed English rhetoric, Caxton's 'rhetor', whose first instruction was to devise some reason to make the hearer glad and willing to listen to him.²¹ The probable and the plausible make different demands on ethos, the former being grounded in context and necessary debate between rhetor and audience, and the latter being more a matter of constructing an image that the audience will want to accept. I have called these 'stance' and 'ethos' in earlier work. For the late sixteenth and early seventeenth centuries, the ethos of the probable is negotiated in conversation, and the ethos of the plausible is often called 'character' and is mediated in 'style'.

The underlying stimulus for several rhetorics from the middle of the sixteenth century is, like that for Thomas Wilson, to distinguish rhetoric from logic, but also to search for the positive effects of rhetoric – even though some, such as Thomas Blundeville, in what could be seen as a desperate attempt to rescue the action of rhetoric, argue that logic is the art of discoursing probably.²² Earlier, in 1573, Ralph Lever is concerned that logic deprives one of the use of copiousness²³ – that topical reasoning so necessary in addressing the diversifying public of the sixteenth-century city, and argues that what one needs is 'witcraft' not logic. Again, Fulwood notes that a civil letter does not use logic but plain familiar speech.²⁴ While these comments are possibly part of the same impetus that led to Peter Ramus's separation of rhetoric from logic that eventually relegated rhetoric to orna-

conference of the International Society for the History of Rhetoric, Saskatoon, 1997, from M. O. Boyle *Erasmus on language and method in theology* (Toronto, 1977); *Annotatlonum in Evangelium Joannis* 1:2, LB vi, 335A.

²⁰ Angel Daie, *The English Secretarie* (London: Robert Waldegrave by Richard Jones, 1586), pp. 44 and 84.

²¹ William Caxton, *The Myrrour* (London: printed by L. Andrews of Calis, 1527), D3.

²² Thomas Blundeville, *The Art of Logike* (London: John Wendet, 1599).

²³ Ralph Lever, *The Arte of Reason, rightly termed, Witcraft, teaching a perfect way to argue and dispute* (London: H. Bynneman, 1573).

²⁴ W. Fulwood, *The Entimie of Idlenesse*, A7r. See also J. Rice Henderson, 'Erasmus on the art of letter-writing', in Murphy (ed.), *Renaissance eloquence*, and *ibid.*, 'Erasmian Ciceronians: Reformation teachers of letter-writing', *Rhetorica* 10, 3 (1992).

ment and without reason,²⁵ these writers make the claim that logic can only speak convincingly or be seen as 'proof' when speaking to a restricted and specialized audience. Rhetoric is therefore needed to provide reason in all other areas.

However, Ramusian rhetoric having most effectively reached England in the 1570s, culminating in Abraham Fraunce's *The Arcadian Rhetoric* of the 1580s, the more substantial and direct response came with, for example, the rhetorics of Peacham and Puttenham, which both explicitly argue that ornament is not the only thing that rhetoric does.²⁶ Henry Peacham notes that one needs both eloquence and wisdom; eloquence to pierce to inward parts of the audience or to gain affection is, on its own, ambivalent, and must be anchored by wisdom or reason. George Puttenham reiterates the observation, saying that eloquence alone is ambivalent, and that honesty is necessary, requiring decency and decorum, first because language is transgressive by nature, and second because the speaker speaks of other people and hence has a responsibility toward them. Both of these arguments indicate a concern with the ethos of rhetoric. In a manner similar to Thomas Elyot who, in his *Dictionary* of 1538, takes on both logic and eloquence, Puttenham draws on the analogy of medicine for rhetoric. Elyot is concerned to distinguish between the eloquence of those like the humanist Lorenzo Valla and the 'many words' rhetoric of Agricola, and does so by distinguishing the former from the latter as a lawyer from a doctor - the doctor being best able to determine the contentious and uncertain. Puttenham's famous description of 'art' shows the artist working at his best as a gardener or physician,²⁷ drawing explicitly on Plato's *Phaedrus* which distinguishes the rhetoric of the actor, and the rhetoric of power, from the rhetoric of love and philosophy conveyed through gardening and medicine.

These later rhetorics, and others of the 1580s, are centrally concerned with ethos and with defining the 'reason' or reasoning process of rhetoric, so that one can distinguish the deceitful from the decent and decorous. Many writers such as Puttenham attempt to establish courtly behaviour as learned but not pedantic, and as non-violent. The move reflects more general concerns in the early philosophy of civic discourse to shift the education of the nobility away from hunting and fishing and fighting toward learning. It goes hand in hand with a growing insistence that fighting is inappropriate within the nation or city or family, and is only tenable in war

²⁵ Peter Ramus, *The Rudiments of P. Ramus his Latin Grammar* (London: Robert Waldegrave, 1585).

²⁶ Henry Peacham, *The Garden of Eloquence* (London: H. Jackson, 1577); George Puttenham, *The Arte of English Poetrie* (London: Richard Field, 1589).

²⁷ *Ibid.*, p.255.

between nations.²⁸ In itself this becomes part of the founding definition of a citizen: the person willing to go to war on behalf of the nation. It is from the 1590s, despite Fulwood's early commentary, that one finds, more and more, the concerns of civic discourse coming to claim the rhetoric of reason and ethos as appropriate to the civic and as different from the rhetoric of the courtier.²⁹

Having gleaned this set of issues from vernacular rhetorics of the 1560s to the 1590s, I would now like to look specifically at three rhetorics from the turn of the century: first, D.T.'s *Essaies Politicke, and Morall* (1608), second Ludwig Bryskett's *Discourse of Civil Life* (1606), and third, James Cleland's *The Institution of a Young Noble Man* (1607). D.T.'s *Essaies* are dedicated to the governess of the children of James I, Lady Ann Harrington. In them the writer talks about the distinction between the rhetorical and the eloquent as one explicitly between the probable and the plausible, and outlines two distinct sets of rhetorical strategy. He argues that a rhetorical event consists of the person persuading, the affections of the audience, and the soundness of reason. As such, ethos is central and can be found in two forms. The person persuading wants the audience to be of his opinion, and to achieve this he may simply insist that the audience agree. However, what he should do is demonstrate that he is trustworthy in his heart, his mouth and his works,³⁰ and negotiate with the audience. Significantly, James Cleland's *Institution*, which is dedicated to the King's younger son Charles, also states that even nobility of birth does not guarantee virtue; virtue must be demonstrated and negotiated with the public because this kind of negotiated rhetoric is appropriate to civil conversation. D.T. here and in his later book *The Dove and the Serpent* (1614) is engaging in a defence of 'opinion' or ethos, which is under attack. For example, B. R.'s *Opinion Dieftied* (1613) rants:

Opinion, the legitimate child of affection, a most inconstant thing, it standeth but upon the pleasure of men, but especially of the irresolute multitude. Opinion a smooke vapour, the breath of the vulgar, the applause of the ignorant, the mother of hypocrisie ... turneth the world topsie-turvie.³¹

²⁸ Francis Bacon, *The Essaies of Sir Francis Bacon* (London: John Beale, 1612 and 1616), p. 239; Richard Robinson, *A morale methode of civille policie, contayninge learned and fruitful discourse of the institution, state and government of a common Weale*, trans. of Francesco Patrizzi (London: Thomas Marsh, 1576).

²⁹ See M. T. Crane, *Framing authority: sayings, self, and society in sixteenth-century England* (Princeton, NJ, 1993); and J. Hankins, 'Humanism and modern political thought', in Krayer (ed.), 1996, pp. 118-141.

³⁰ D.T., *Essaies Politicke, and Morall* (London: H. L. for Mathew Lownes, 1608), f. 10v.

³¹ B. R., *Opinion Dieftied. Discovering the Ingins, Troups, and Traynes that are set in this Age whereby to catch Opinion. Neither flourished with art or smoothed with flatterie* (London: for Thomas Adams, 1613), pp. 32-3.

The affection of the audience, or pathos, is also clearly under attack, and D.T. goes to some lengths to defend it as under the governance not only of passion and the senses but also of the soul.³²

The third element in D.T.'s rhetorical event is reason, and he argues that it works by way of probable conjecture, to demonstrate need, not, as he says, against a sense of justice and 'honestie',³³ but instead to ensure that reasoning about necessity is wrapped up in and contextualized by ethos. The main strategies are not syllogisms but rhetorical enthymemes and inductions, 'especially when they be seconded by a lively and decent action'.³⁴ And yes, rhetorical eloquence may be separated from 'decencie', at which point it becomes 'a dangerous weapon in a mad man's hand'.³⁵ And yes, it may be abused, especially when government is impoverished. But it need not be like this plausible rhetoric aimed at 'sharpness' (in the sense of 'sharp practice'). Probable rhetoric is perspicuous. It addresses a diverse audience much as the physician heals different people in different ways³⁶ – remember that the predominant medical system is still Galenic – and to do so it must use the topics and commonplaces to reach that diversity.³⁷

What is significant about probable rhetoric is that while rhetoric and its ethos usually leads to the topos of 'good counsel' from subject to monarch, which is standard to humanist literature about courtly behaviour, D.T. sees it as central to the development of friendship. Friendship between equals, within either liberal or mechanical professions, he says, is not lightly given because equals are always competing within their fields. Furthermore, friendship between those of 'different meanes, or mindes' is difficult because of those differences.³⁸ But a rhetoric of perspicuity is not competitive, and is constructed to deal with difference. In this he echoes Fulwood's avocation of familiar speech over 'rare and diffused speech'.³⁹ In *The Dove and the Serpent* (1614), these issues are developed further into the concepts of conversation and negotiation, *sermo* and *negotio*.⁴⁰ There they are also tied to a particular kind of civic behaviour that, in common with other writers of the period to 1615–20, he sets up against the ambivalence of the potentially deceitful courtier.

³² D.T., *Essates*, f. 15v.

³³ Ibid., f. 26.

³⁴ Ibid., f. 27v.

³⁵ Ibid., f. 29.

³⁶ Ibid., f. 30.

³⁷ Ibid., f. 30v.

³⁸ Ibid., f. 95.

³⁹ Fulwood, *Enimie of Idlenesse*, A7.

⁴⁰ D.T., *The Dove and the Serpent. In which is conteined a large description of all such poyns and principles, as tend either to Conversation, or, negotiation* (London: T. C. for Laurence L'isle, 1614).

Rhetorics of *sermo* and *negotio* also become indicators of behaviour during this period. For example one finds S. Gibson in 1616 arguing that preachers must speak profitably, not plausibly, and must be honest and unrepachable in conversation.⁴¹ From being civil behaviour in court, marked by learning and oratory, this kind of negotiated rhetoric becomes, around 1590-1600, an indication of personal behaviour in the civic and economic worlds. However, from just slightly later, around 1630, 'conversation' becomes synonymous with private personal behaviour until at least the end of the seventeenth century. In the brief interlude upon which I am focusing, it is as if the potential for deceitful rhetoric in all areas outside logic and *ratio* becomes more and more worrying, more and more an articulated anxiety. For example William Vaughan's *The Golden-grove* (1608), which addresses politics, the civic and the economic, speaks of truths as faith and promise 'nowadays' beset by fraud,⁴² and of deceit becoming ever more rife.⁴³ As it does so, a probable rhetoric of trustworthy ethos is pushed from the posed civility of the courts toward the civic and eventually, via the economic of the familial, into private and finally spiritual behaviour. So that by 1616, I. B., among others, reflects a growing emphasis on the negative effects rather than the skill of flattery and deception in the courtesy of civil speech.

But just at this juncture, 1600-20, a negotiated rhetoric of conversation as an indicator of personal behaviour and economic relationships also becomes a marker of the 'middle people' - as Bacon calls them in 1597 - or, as described by M. R. in *A President for Young Pen-Men* (1615), a marker of the 'carriage of civility' for those between the lord and the lackey. The early sixteenth-century books on civic rhetoric, because of their focus on courtly behaviour, speak of the necessity of learning conversation in the city. Conversation needs practice, meeting and companying, and conversational *negotio* is contrasted with the otiose of country life. Puttenham underwrites this context when he claims that to learn civil and gracious behaviour you need to be within 50 miles of London,⁴⁴ although he also depicts some *otium* as hidden *negotium*.⁴⁵ The point about conversation is that it unifies the rhetoric of gesture with that of language, it brings the body and mind together, whereas in the otiose and in *ratio*, the mind only is at work. A number of

⁴¹ S. Gibson, *The Only Rule to walke by: Guiding Christs Ministers, and all his members, how to frame their conversation in the way to salvation* (London: by George Purstowe for Ralph Mab, 1616), C2v, 16.

⁴² W. Vaughan, *The Golden-grove, moralized in three Bookes; A word very necessary for all such, as would know how to governe themselves, their houses, or their countrey* (London: Simon Stafford, sold by Richard Serger and John Browne, 1599 and 1608), 155, F4v.

⁴³ Ibid., G2v.

⁴⁴ Puttenham, *English Poesie*, p. 120.

⁴⁵ Ibid., p. 251.

writers point this out, including Edward Willis in 1615, who contrasts the work of both body and mind in civil discourse with the split that occurs in 'idlenesse'; or Bryskett who contrasts conversation with the intellective *ratio* devoid of both reason and passion. This collocation of words is clearly moving partly towards the concept of a 'work ethic' in conversation, negotiation and business. Bacon discusses negotiation largely under the topic of economics.⁴⁶ At the same time the collocation makes it clear that if one uses *ratio* alone, if one isolates oneself from discussion, one splits the body from the mind, and loses contact with emotion, passion and reason. One thus belies completely any sense that Descartes' use of *ratio*, and the split of mind from body, was anything more than an individual's plausible opinion or otiose whim, and certainly could not have been accorded the status of reason or truth.

But the third term in the collocation, 'city/country', shifts its significance with the shift of 'civic' from the court to civility and the middle people, probably following a change in the social use of the country and the development of the country house and of course a tremendous change in the scope of urban life.⁴⁷ Increasingly, civil conversation is associated not with the city itself but with civic life, the economic and hence familial life, and with business dealings in any place, even in the country. There is a particular emphasis on familial life as the training ground for the individual's behaviour that will feed into the city and eventually the nation. Familial training is a concept that is found in Patrizzi, in Guazzo and in della Casa, but is there downplayed in relation to the instructions on courtly behaviour. In later English works, familial training seems precisely to deal with the gap left by the breakdown of the feudal concept of 'service' which occurs during the latter part of the sixteenth century. Lodowick Bryskett's *Discourse of Civill Life* (1606), which is a translation of another Italian work, by Giraldi, speaks of acquiring civility and civil conversation in domestic and familiar settings in order to focus on the moral and intellectual aspects of life,⁴⁸ although always in preparation to serve the nation. This line recurs in a number of places, not only in the younger Henry Peacham's *The Compleat Gentleman* (1620) but also in Thomas Braithwait's *The English Gentleman* (1630). Braithwait's famous line, 'As every man's house is his Castle, so is his family a private Common-wealth',⁴⁹ separates the domestic world from the

⁴⁶ Bacon, *Essaies*, p. 193.

⁴⁷ C. Wilson (ed.), *Skills and equipment for provisioning the country house, 1700-1900* (Stroud, 1996).

⁴⁸ Lodowick Bryskett, *A Discourse of Civill Life: containing the Ethike part of Morall Philosophie: fit for the instruction of a Gentleman in the course of a vertuous life*, trans. of Giraldi (London: for William Aspley, 1606), p. 92.

⁴⁹ Thomas Braithwait, *The English Gentleman and English Gentlewoman* (London: John Dawson, 1630/1635) [1641 edition including *The Turtles Triumph*, Presented in a Supplement], p. 87.

economic, moves the former firmly into the private and defines it as the root of sacred and moral knowledge.⁵⁰

The inexorable alliance of civility with personal life and behaviour begins to take on, in Bryskett and others, the idea of 'true' personal life: the need for irreproachable actions. He notes that it is not enough to have merely a good image, you need good manners and you learn these in the domestic and familial world, which for him is best found in the country - although his 'country' is close to the city, and trains one for action within it. Bryskett also notes that 'comliness', the ultimate focus on physical beauty as one's ethos, is not a good indicator of personal worth, and that the 'misshapen' can be 'nurtured' by conversation.⁵¹ Picking up on the other extreme, of linguistic ethos, an exemplary letter from the country to the city in *A President for Young Pen-Men* (1615) notes, with surprise, that the city man is writing 'like himself' and not just with 'bare words'.⁵² Braithwait, who sanctifies the country as a topos for proper familial training, echoes this in his anxiety to distinguish the true orator from the actor or mere 'verbal rhetorician'. A gentleman's education consists in liberty (individual), conversation (familial) and public society. Therefore to show that he is 'prudent' rather than 'ridiculous' he must learn to converse over matter and not just with words,⁵³ again learning that skill in the family but for the public good.

Alongside this commentary on training in civil conversation, there runs an on-going attempt to distinguish the public role of conversation, in serving the nation in the city, from the actions of the courtier who may claim to do the same at court. The entire debate is grounded in an opposition between negotiation and focus on words on the one hand, and the visual fashion of court style on the other. The topos develops out of the notion of plausible rhetoric as sleight of hand, visual trickery, done by the rhetor to the audience, as opposed to probable rhetoric as an interchange between rhetor and audience, and having its primary location in speech. However, 'interchange' is also found in letter-writing, and thence more broadly and later as an element of diaries, journals and autobiographies. Fulwood notes in 1568 that the best letter-writing is that which makes the reader feel as if the writer is present.⁵⁴ But Fulwood also notes that it is the primary work of the rhetor to get the benevolence of the audience by recognizing and valuing it for itself, which is the ethos position of negotiation. In 1597 Bacon extends this in his essay on 'Discourse', saying that it should be

⁵⁰ Ibid., p. 92.

⁵¹ Bryskett, *A Discourse of Civill Life*, p. 33.

⁵² M. R., *A President for Young Pen-Men. or the Letter-Writer* (London: G. Eld for Robert Wilson, 1615), F3v.

⁵³ Braithwait, *English Gentleman*, p. 47.

⁵⁴ Fulwood, *Enimie of Idlenesse*, Aiii.

'interlocutory' and adjusted to the needs of its audience – first, so that they understand what is being said, and second, so that in the understanding of the audience the rhetor or speaker can learn from them.⁵⁵ These points are reiterated frequently in discussions of conversation throughout the seventeenth century, for example in John Evelyn's *Public Employment ...* (1667), a classic defence of *negotio* against *otio*, which continues to ally conversation and *negotio*, but which shifts the alliance of *otio* with the country or with idleness to an alliance with the 'closet'. The closet holds both the sense of the private and sexual, and the sense of secrets or a 'club culture', which has since been seen as the rhetorical basis not only for fantasy but also for the structure of the liberal social contract which was of course beginning to take shape by the end of the seventeenth century.⁵⁶

In contrast, court style is focused on the rhetor alone who is, as John Cleland's *The Institution of a Young Noble Man*, of 1607, puts it, 'a slave to one humour, self-love'.⁵⁷ Earlier Puttenham calls those of 'little conversation' those people who keep to themselves, 'phantasticall' men,⁵⁸ and contrasts them with those who delight in a busy life, exercise and invention, whose speech is the image of their heart.⁵⁹ The man of conversation is a man of action, because as Cleland says, it is one's duty to move toward action in the service of one's country.⁶⁰ It is not enough to know things,⁶¹ hence courtly displays of learning are not good enough. This is a theme echoed not only in the younger Peacham, but also in many of the plans of education drawn up by teachers for students and fathers for sons throughout the seventeenth century. Furthermore, because the end of conversation is action, one needs prudence, justice and temperance,⁶² not fashion,⁶³ nor, with Braithwait, 'rhetorical varnish'.⁶⁴

Bryskett allies prudence with reason, which engages and controls passion, as opposed to the intellective, which represses passion completely into the rational and/or sublime contemplative. D.T. in 1608 reiterates this but emphasizes that compassion is controlled passion, that reason tells us that civility is steadfast and faithful but not beyond 'pietie and equitie',⁶⁵ and that passion

⁵⁵ Bacon, *Essaies*, pp. 117–8.

⁵⁶ For this, see Carol Pateman, *The problem of political obligation: a critique of liberal theory* (Cambridge: 2nd edn, 1985).

⁵⁷ James Cleland, *The Institution of a Young Noble-Man* (Oxford: Jos. Barnes. 1607), p. 168.

⁵⁸ Puttenham, *English Poesie*, p. 14.

⁵⁹ *Ibid.*, p. 15.

⁶⁰ Cleland, *Institution*, p. 9.

⁶¹ *Ibid.*, p. 163.

⁶² *Ibid.*, p. 164.

⁶³ *Ibid.*, pp. 5–6.

⁶⁴ *Ibid.*, p. 399.

⁶⁵ D.T., *Essayes Politicke, and Morall*, p. 19.

alone leads to self-love. Cleland's notion of prudence extends these comments into a concept of 'commonality', that the conversational rhetor speaks to many, not just to a restricted group (club culture again). As Gibson later points out, speaking to a mixed audience requires one to frame one's conversation carefully,⁶⁶ what Cleland calls 'decorum' in words. In this, Cleland is reiterating the earlier commentaries on the decorum of conversation,⁶⁷ on the need to be 'copious and meete',⁶⁸ to have discretion and measure,⁶⁹ and 'decencie'.⁷⁰ Cleland himself advocates the 'apt and meete'⁷¹ of prudence: 'O dear prudence, how necessary art thou for our life and conversation'.⁷² And Cleland ties 'commonality' to his argument that virtue is the source of nobility, not birth or wealth; and this virtue is shown and learned in action and conversation. Indeed he notes that it is a rare thing for a nobleman to be common, and when achieved it is an 'imitation of God's goodness'.⁷³

Yet, embedded in Cleland's concept of prudence, virtue and commonality is not only a sense of democratic individualism but also a belief in a common universal humanity. Cleland states that the best wit is also universal. This cluster of significant words around prudence – decorum, 'apt and meete', 'decencie', discretion and measure – is echoed in Braithwait's insistence on prudence for 'neighbourliness',⁷⁴ for which you engage in discourse and communication, action and negotiation, pastime and recreation, but relatively unproblematically. The same cluster hovers around the notion of prudence in Hobbes' *Briefe of the Arte of Rhetorick* (1639), but here one sees the problem of the simultaneous existence of the autonomous individual and the universal man emerging, for ethos is a function not only of virtue in the rhetor but also of passion in the audience.⁷⁵ The simultaneity is famously articulated in *Leviathan* in terms of the rhetoric of governmental power and the need for the person both to be represented by one inclusive image as well as being an individual.

While this notion of negotiated rhetoric is democratic in its emphasis on experience and good works, it also internalizes the conflicting systems of value by birth and/or by virtue or works that Castiglione's *The Courtier*

⁶⁶ Gibson, *The Only Rule*, dedication.

⁶⁷ T.B., *A Ritche Storehouse*, f. 44v.

⁶⁸ Ibid.

⁶⁹ John della Casa, *Galateo: ...A treatise of the manners and behaviours, it behouvethe a man to use and eschewe, in his familiar conversation* (London: for Raufe Newbery, 1576).

⁷⁰ Puttenham, *English Poesie*, pp. 124–5.

⁷¹ Cleland, *Institution*, p. 169.

⁷² Ibid., p. 167.

⁷³ Ibid., pp. 168–9.

⁷⁴ Braithwait, *English Gentleman*, pp. 72–3.

⁷⁵ Thomas Hobbes, *A Briefe of the Arte of Rhetorick* (Oxford: C.A. Tallboys, 1833; reprinted from 1681; 1st edn 1639), p. 295.

attempted to keep separate. Anyone living in a world in which ambition can change their status must see the possibility of change for all people. Hence they must also accept that this is not always possible. Bacon says explicitly that not all people should aim to be noble for that renders those left without nobility as peasants, 'base swaine driven out of heart',⁷⁶ people with no value or virtue. It is here that he refers to the middling people so necessary to the civic world of a nation. *Negotio* becomes a place of doublethink: the place where you accept that certain elements of the individual will be repressed or suppressed to serve the state.

After Hobbes, but not necessarily because of Hobbes, 'conversation' and *sermo* rhetoric become increasingly separated from negotiation, and retained in two areas, first in the spiritual behaviour of the private individual, and second in the family, especially in women's language and in the communal writings of letter, diary, journal and autobiography. *Negotio* itself is most fully retained in the concept of subjecthood: the schizophrenia of the citizen and subject of the state and its attendant analyses in psychology and psychoanalysis.

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⁷⁶ Bacon, *Essaies*, p. 236.

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Plato in the Tudor academies

Sarah Hutton

PROLOGUE

Platonism has little directly to do with Gresham College. Its chief relevance to Sir Thomas Gresham's educational foundation is as part of the general context of Tudor intellectual life. Moreover, in so far as I am concerned with the kind of intellectual culture a particular educational institution produced – the relationship between Platonism as a school of thought and the school from which it came – parallels may be drawn with the intellectual culture that Gresham College helped to shape. And, as I shall show later, there is a tangible link between Gresham College and Emmanuel College, Cambridge, seed-bed of the best-known form of English Platonism, namely the school of thought which has come to be known as Cambridge Platonism.

CAMBRIDGE PLATONISM: ORIGINS

Cambridge Platonism tends to be treated as an isolated phenomenon, thrown up by particular historical circumstances, and without a far-reaching legacy. As its name suggests, Cambridge Platonism was a university phenomenon, the product of a particular academic culture. All its main proponents – Benjamin Whichcote, Ralph Cudworth, Henry More and John Smith – studied and taught at the University of Cambridge, and all but More at Emmanuel College. But in their adoption of Platonism, as opposed to Aristotelianism, as the philosophical underpinning of their intellectual position, and in their liberal theology of grace, they were at odds with the dominant elements of the academic culture in which they were educated. If, as I want to argue, Cambridge Platonism is the outcome of a particular educational history, we have to account for the fact that it represents a divergence from the mainstream of academic culture of seventeenth-century Cambridge. In this paper I shall discuss the academic roots of Cambridge Platonism by examining two examples of Platonist antecedents nurtured in Elizabethan times, Everard Digby and Thomas Jackson.

PLATO IN THE RENAISSANCE

In the Renaissance the philosophy of Plato was read and valued more than at any time since the closure of the Athenian Academy by the emperor Justinian in 529 A.D.¹ With Marsilio Ficino's translation of all thirty-six dialogues of the Thrasyllan canon of the works of Plato (1484), and the Aldine edition of 1513, Plato's philosophy became accessible as never before. Ficino also translated the *Enneads* of Plotinus (1492) and the Hermetic writings, *Pimander* and *Asclepius* (translated in the early 1460s, printed in 1471). Nonetheless, although Platonism appeared as a new component of the intellectual culture of the Renaissance in the wake of the humanist movement, it never dominated the philosophical scene nor did it succeed in dislodging Aristotelianism as the core of the university curriculum.² This was as true in England as in the rest of Europe.

PLATO IN GRESHAM'S ENGLAND

In 1578 the French Protestant Jean de Serres (Joannes Serranus) dedicated his edition and translation of Plato's works made in collaboration with Henri Estienne (Henricus Stephanus) to Queen Elizabeth I.³ While this dedication may have served to recommend Plato in court circles, the only English translation of Plato to be printed in the sixteenth century was the pseudo-Platonic dialogue *Axiochus* (London, 1592). Actually written by Xenocrates, this text was translated by one 'Edw. Spenser', purportedly from the Greek but possibly from French.⁴ The only dialogue by Plato to be printed in Greek in England was the *Menexenus* which appeared in 1587.

¹ James Hankins, *Plato and the Italian Renaissance*, 2 vols (Leiden, 1990).

² Some of Plato's dialogues did, however, figure in the curricula of Greek courses in European universities and grammar schools of the Renaissance; see P. O. Kristeller, *Renaissance thought* (New York, 1961), pp. 60-61.

³ *Opera*, ed. Henri Estienne, translated by Jean de Serres, 3 vols (Geneva, 1578-79). The earliest direct contact between Italian Platonism and England was that between Humphrey, Duke of Gloucester, and two translators of the *Republic*, Leonardo Bruni and Pier Candido Decembrio (1392-1477). Another example of direct contact between Ficino and England is Sir Thomas More's friend, John Colet (c.1467-1519), who corresponded with Ficino, and whose lectures on Romans VI-XI show the influence of Ficino's theological thought. See Sears Jayne, *John Colet and Marsilio Ficino* (London, 1963). For the literary impact of Platonism, see A. Baldwin and S. Hutton, *Plato and the English imagination* (Cambridge, 1994).

⁴ The *Axiochus* was translated in a collection attributed to the Huguenot leader admired by Sir Philip Sidney, Philippe du Plessis Mornay, *Six Excellent Treatises of Life and Death* (London, 1607). *Axiochus* was published by the French printer Josse Badius in 1530. See A. Tilley, *Studies in the French Renaissance* (New York, 1968; 1st edn 1922), p. 145. The Greek text of the *Axiochus* is included as one of Plato's Dialogues in early editions of Plato's works, including the Aldine edition (Venice, 1513), the 1590 Ficino edition, and Serranus' 1578 edition.

No Latin or English translation of Plato was printed in England until the late seventeenth century.⁵ There were, of course, other sources of Platonism in Tudor England. The most important mediator of Platonism in Elizabethan secular culture was probably Baldassar Castiglione's *Il cortegiano* (*The Courtier*). As is well known, this was translated by Thomas Hoby as *The Courtyer* in 1561.⁶ In Elizabethan times the Latin translation by the Englishman Bartholomew Clerke, *De curiali sive aulico libri quatuor* (1571), was probably more widely circulated than Hoby's translation. Although these publications testify to a knowledge of Plato in Tudor England, that knowledge was sparse compared with France. Quite how bleak the picture was, is demonstrated in detail in Sears Jayne's study, *Plato in Tudor England*, to which I am greatly indebted in this study.⁷

In the universities the continuing dominance of Aristotle is everywhere apparent in the syllabus of the arts curriculum.⁸ It is true that works by Plato (for example the *Laws*, which was more widely read in Tudor England than any other dialogue including the *Symposium*) were included on the list of possible texts for instruction at certain points on the curriculum. This is the case, for instance, with the Edwardian statutes, endorsed in the Elizabethan statutes, which stipulated that the professor of philosophy should teach Aristotle, Pliny and Plato.⁹ But how extensively Plato was used is not clear. And, as in this example, Plato's name usually appears as one of several optional authors, never as a core text. There were exceptions to this, of course, notably in the regulations of individual colleges. And it is notable that it was at the new humanist foundations – such as Corpus Christi College, Oxford, and St John's College, Cambridge, which pioneered the study of Greek – that Plato's name occurred most frequently in the college curriculum. But even here, the texts by Plato are recommendations rather than prescriptions, though in 1545 the Statutes of St John's were revised to extend the teaching of Plato beyond Greek to philosophy. At Corpus Christi

⁵ A selection of dialogues (*Apology*, *Crito*, *Phaedo*, *Laws X*, *Alcibiades II*) was published with the title *Platonis de rebus divinis, dialogi selecti* (Cambridge, 1673). The only English translation of Plato to be printed in England in the same century was *Plato his Apology of Socrates and Phaedo or Dialogue concerning the Immortality of Man's Soul, and Manner of Socrates his Death* (London, 1675).

⁶ J.W. Binns, *Intellectual culture in Elizabethan England* (Leeds, 1990), pp. 258 ff.

⁷ Sears Jayne, *Plato in Tudor England* (Dordrecht, 1995). I am grateful to Professor Jayne for his comments on this paper.

⁸ See especially, C.B. Schmitt, *Aristotle and the Renaissance* (Cambridge, 1983). Also B.P. Copenhaver and C.B. Schmitt, *Renaissance philosophy* (Oxford, 1992).

⁹ On the Tudor and early-Stuart University curriculum, see W.T. Costello, *The Scholastic curriculum at early seventeenth-century Cambridge* (Cambridge, Mass., 1958), M.H. Curtis, *Oxford and Cambridge in transition, 1549–1642* (Oxford, 1959), H.F. Kearney, *Scholars and gentlemen. Universities and society in pre-industrial England* (London, 1970), J.E. McConica (ed.), *History of the University of Oxford III: the Collegiate University* (Oxford, 1986).

College, Plato does not figure on the list of authors to whom the lecturer in Greek might refer. But readings from Plato or a Greek theologian are prescribed for feast days. And Plato does not figure on the author list for the lecturer in humanity. In Cambridge, Erasmus used Plutarch and Lucian rather than Plato in his university teaching. Any favourable influence on the study of Plato that Erasmus might have had was to be countered in the reign of Edward VI when Martin Bucer was resident at Cambridge. On the other hand the same Injunctions which prescribed Bucer's works for study in 1535, also prescribed the works of an admirer of Plato, Philip Melanchthon.¹⁰ Although some college libraries were well supplied with Plato texts, in 1549 the purging of libraries in the wake of a campaign to eliminate Catholic books led to the loss of all but one of Duke Humphrey's Plato manuscripts.¹¹ The dearth of Platonic teaching is registered by the absence of citations and allusions. James McConica has noted both that 'citations of such works are exceedingly rare' and 'the notable absence of Platonic and Neoplatonic texts, at least in graces, private libraries and notebooks'.¹² Indeed, there is evidence that Plato was regarded with some suspicion in university circles: John Anderson, Rede Professor of Logic at Trinity College got into trouble for sympathy with Catholic doctrine, and for using allegory and citing Plato while interpreting scripture.¹³

The reasons for the failure of Platonism to make much impact on Renaissance university education have much to do with the nature of Aristotelianism as the dominant component of academic discourse: its entrenched position, its comprehensive scope and, as Charles Schmitt showed, its adaptability ensured its survival in the face of alternatives.¹⁴ Besides, Platonism was not adapted for consumption in the universities of the Renaissance. From Ficino on, printed texts of Plato's dialogues were given the appearance of a systematic philosophy, with titles like *Timaeus vel de natura*, *Gorgias vel de sapientia*, *Amatores vel de philosophia*, and so on. But there was no handy textbook of Platonism which made it possible to use it in the arts curriculum as it had evolved. We might also consider that there is a modern tendency to over-stress the opposition between Plato and Aristotle, and that, therefore, to expect the impact of one on the other to take the form of displacement is a false expectation. Rather, we should be attuned to forms

¹⁰ Bucer expresses anti-Plato views in his *Commonplaces*. Melanchthon, on the other hand, published two sets of selections for school use, one in 1518 and the other in 1525, both of which include extracts from Plato (Jayne, *Plato*, p. 90).

¹¹ Jayne, *Plato*, p. 92.

¹² J. E. McConica, 'Elizabethan Oxford', in McConica (ed.), *The Collegiate University*, pp. 712-3.

¹³ D. R. Leader, *A History of the University of Cambridge I: the University to 1546* (Cambridge, 1988), p. 351.

¹⁴ Schmitt, *Aristotle and the Renaissance*, especially ch. IV.

of syncretism standard in the Renaissance, when even avowed Aristotelians might cite Plato with approval.¹⁵ I shall return to this point later. When assessing the fortunes of Platonism, there are, of course, other factors, some of them local, to take into account – especially theological considerations. But for the moment I shall concentrate my attention on the question of how Platonism emerged from a basically Aristotelian framework of learning.

The general picture in England, as on the continent, is that Platonic philosophy did not become institutionalized within traditional seats of learning,¹⁶ but it is the case that colleges founded on humanist lines were well supplied with texts of Plato: an example is Corpus Christi College, Oxford, founded by Bishop Fox in 1517.¹⁷ It is also the case that the small band of individuals that can be called Platonists in Tudor and Stuart England were educated at colleges at the forefront of the humanist introduction of Greek studies. Corpus Christi College in Oxford and St John's College and Christ's College in Cambridge each, at different times, produced one or more Platonists: the Cambridge Platonists of Christ's College have forerunners in Thomas Jackson at Corpus Christi and Everard Digby at St John's. These may be isolated instances. They certainly do not add up to an overwhelming tide of Elizabethan Platonism. But from them we can perhaps learn something about changes in intellectual formations within the context of a dominant philosophical discourse.

CARDINAL COLLEGE

Before examining these cases in any detail, it is instructive to pause for a moment to examine a still-born project for the founding of a college on humanist lines: Wolsey's projected Cardinal College. Wolsey's plans to found a new college at Oxford started to take shape in 1523 and building began in 1525. His intention was to found a college similar to, though grander than, the tri-lingual college at Louvain. Cardinal College, as it was to be called, was to be a showpiece of the new humanism. The six public lectureships at the college included a lectureship in humanity to which Juan Luis Vives was appointed in 1523. Books were purchased for the library in Rome and Venice. Most significantly for any potential interest in Platonism, arrangements were made for the copying of all the Greek manuscripts in the

¹⁵ For example, John Case, on whom see C.B. Schmitt, *John Case and Aristotelianism in Renaissance England* (Kingston and Montreal, 1983).

¹⁶ On the continent, it flourished in newly founded academies, described by Kristeller as 'half learned society half literary club'. To my knowledge there were no such academies in England.

¹⁷ The library of Corpus Christi College contained the translations of Plato by Ficino, Serranus, and the Aldine edition. See J.R. Liddell, 'The Library of Corpus Christi College, Oxford', *The Library*, 4th series, 13 (1938), pp. 385-416.

library of Cardinal Bessarion. Commenting on the significance of this project, Sears Jayne notes, 'If Cardinal Wolsey had actually managed to transplant to an Oxford college the entire corpus of the Greek manuscripts of Cardinal Bessarion, the study of Plato in England would certainly have been advanced dramatically'.¹⁸ But Wolsey did not achieve his aim: work on his college was abruptly halted when he fell from power in 1529. His grandiose scheme for a foundation of humanist learning proved a false dawn.¹⁹

CORPUS CHRISTI COLLEGE, OXFORD

Although the remnants of Wolsey's scheme were incorporated in the new college of Christ Church, the torch of humanism was kept alight elsewhere. Perhaps the most important of the new, humanist-inspired foundations was Corpus Christi College, Oxford, the brainchild of Bishop Richard Fox, which 'served as a model for later Tudor foundations'.²⁰ Corpus proved a model and inspiration for John Fisher when he founded St John's College and Christ's College in Cambridge. When he founded Corpus in 1517, Bishop Fox ensured that it reflected the then new educational ideals of humanism. Indeed, it won the praise of Erasmus for that very reason.²¹ Fox made provision for three public lectureships: in humanity, in Greek and in sacred theology. Moreover, scholars were required to have private instruction in Greek during the vacations. And there was a scholarship for travel abroad. The first lecturers in humanity included such distinguished humanists as John Clement (formerly tutor to Sir Thomas More's children), Thomas Lupset, Nicolas Udall and Juan Luis Vives. Plato was not prescribed on the college Greek syllabus, though readings from 'divine Plato' could be given on feast days. Nonetheless, the College Library possessed three editions of Plato's works, including the Aldine edition, three commentaries on Plato by Proclus, and the *Enneads* of Plotinus. Two of these items were donated by the founder, and one by the first president, John Claymond.²² The new emphasis on Greek studies did bring about some interest in Plato: Thomas Lupset quotes Plato and recommends reading *The Republic* in his treatise on lay morality, *An Exhortacion to Yonge Men* of 1529.²³ And a Corpus graduate, John Redman, who went on to study in Paris, was recruited to St John's

¹⁸ Jayne, *Plato*, pp. 85-6.

¹⁹ On the founding and failure of Cardinal College, see J.E. McConica, 'The rise of the undergraduate college', in McConica (ed.), *The Collegiate University*, pp. 1-68, esp. 31ff. As G.D. Duncan notes, Christ Church owed much to Wolsey's abortive schemes; see his 'Public lectures and professorial chairs', in McConica (ed.), *The Collegiate University*, p. 345.

²⁰ McConica, 'Rise of the undergraduate college', p. 17.

²¹ Ibid., p. 66.

²² Liddell, 'Library of Corpus Christi College', p. 404.

²³ Jayne, *Plato*, p. 88.

College, Cambridge, in 1524. He evidently used Plato in his Greek course, leading others to do the same.

ST JOHN'S COLLEGE, CAMBRIDGE

In Cambridge, Bishop John Fisher's two foundations, St John's College and Christ's College, were modelled on Corpus. The statutes of St John's were based on those of Corpus, and the statutes of Christ's were modelled on those of St John's. In the words of McConica: 'Fox's foundation [Corpus] was to Oxford what St John's was to Cambridge: the first permanent home of the new learning in the universities'.²⁴ And at St John's College, along with its sister foundation, Christ's College, Fisher (like Fox at Oxford) made provision for lectureships in humanist subjects: Latin and Greek, rhetoric and moral philosophy. The college statutes show the dominance of Aristotelianism in the curriculum.²⁵ Nonetheless, an interest in Plato is discernible among St John's alumni, who include the Tudor humanists John Cheke, the first Regius Professor of Greek at Cambridge, who taught Plato in tutorials, and Roger Ascham, later tutor to Princess Elizabeth. Ascham displays his knowledge of Plato in his letters and *Toxophilos*, but his knowledge did not go deep: he had read the *Phaedrus*, but relied on florilegia for other quotations.²⁶ Among other St John's humanists were William Framyngham, whose book lists show he owned several Platonist works,²⁷ and Nicolas Carr, who lectured on Plato, translated sections of the *Laws*, *Symposium* and *Timaeus*, and wrote commentaries on the first two.²⁸ It is very likely that John Dee's interest in Platonism was nurtured while he was at St John's. And, in 1517, St John's supplied a master for Christ's in the person of Erasmus's pupil, John Watson. The future Master of Peterhouse (1554) and Vice-Chancellor of the University of Cambridge (1551-52), Andrew Perne, was a St John's graduate (MA 1549): his large private library is striking for the number of Platonist texts he owned, including Plotinus, Hermes Trismegistus, and Apuleius.²⁹

Tudor England was not, therefore, without its readers of Plato, and one can pinpoint many instances of university men who knew enough of Plato to quote him. But there are only two cases of university men in whom a

²⁴ J.E. McConica, *English humanists and Reformation politics under Henry VIII and Edward VI* (Oxford, 1965), p. 80. According to D.R. Leader, 'The influence of Christ's and St John's College on Cambridge was striking'; Leader, *History I*, p. 290.

²⁵ Ibid., p. 309.

²⁶ Jayne, *Plato*, p. 86.

²⁷ See E. Leedham-Green, *Books in Cambridge inventories I* (Cambridge, 1986), pp. 6-9.

²⁸ Jayne, *Plato*, pp. 86, 90, 93.

²⁹ Leedham-Green, *Books in Cambridge inventories I*, pp. 449-481. Perne owned, inter alia, three copies of Plato's works, in Latin, a translation of Plotinus, of Hermes Trismegistus and a copy of Apuleius, as well as Carpentarius' *Comparatio* and Digby's *De Duplici methodo* and *Theoria analytica*.

knowledge of Platonism translates into a Platonic cast of thought. Both were graduates of humanist colleges founded in Henrician times: Everard Digby of St John's College in Cambridge, and Thomas Jackson of Corpus Christi College in Oxford.

EVERARD DIGBY

Everard Digby (b. c.1550) entered St John's College, Cambridge, as sizar in 1567 and was later (1573) elected to be Queen Margaret Fellow. Ten years before the founding of Gresham College, Digby was deprived of his fellowship for alleged breaches of the statutes and romanist tendencies. The old *DNB* article expresses the view that his chief claim to fame was as the author of the earliest treatise on swimming to be published in England.³⁰ Of more relevance to the present discussion are Digby's ideas on method, as set out in *De duplici methodo* (1580) and his treatise *Theoria analytica* (1579) which Charles Schmitt has called 'the first serious, published philosophical work in Britain after the coming of the Reformation' and one which 'has some claim to be considered the first British philosophical work since the Middle Ages to be addressed to a learned international audience'.³¹ Digby draws on a wide range of Platonist sources including - besides Plato - Plotinus, Porphyry, Iamblichus, Proclus, Pseudo-Dionysius and Hermes Trismegistus, as well as Apuleius and Alcinous. He is indebted to Ficino and Pico and invokes the Christian Cabbalists, Reuchlin and Agrippa. But Digby is also well-versed in Aristotelianism, citing, in particular, Aristotle's earliest commentators, Alexander of Aphrodisias and Themistius. Nonetheless, *Theoria analytica* sets out a Platonist metaphysics. For Digby, all things, including the human mind, derive from the divine ideas in the mind of God. All things are therefore blessed with a spark of the divine. Throughout, like Pico, Digby stresses the rational faculty in man and his ability to love God. We are able to ascend towards an apprehension of the divine through our exercise of reason. Once we attain to knowledge of the intelligible principles of being, we can descend to certain knowledge of the world.

Although I have referred to Digby as a Platonist, he is also considered to be an Aristotelian. This is not surprising in view of his very public quarrel with William Temple, in which he defended Aristotle against the challenge of Ramism, then fast gaining ground in Cambridge.³² Digby's knowledge of

³⁰ On Digby, see S.A. Akester (née Butters), 'Life and Works of Everard Digby, c.1551-1605', DPhil, Oxford University (1980). Also, N.W. Gilbert, *Renaissance concepts of method* (New York, 1960).

³¹ Schmitt, *John Case*, pp. 48 and 47.

³² Akester and Gilbert, cit. supra at note 30. See also, L. Jardine, 'The place of dialectic teaching', *Studies in the Renaissance* 21 (1974), pp. 31-62; eadem, *Francis Bacon. Discovery and the art of discourse* (Cambridge, 1974).

the Aristotelian corpus matches his wide reading in Platonist sources. Arguably this was only possible on the basis of a humanist acquaintance with classical sources, and is therefore not the mark of a scholastic. It is, therefore, wrong to assume, on the basis of his opposition to Ramus, that he was a conservative, defending the intellectual status quo against newcomers.³³ The combination of Platonism and Aristotelianism in his work means that if we are going to classify him as an Aristotelian, it has to be within that useful loose category suggested by Charles Schmitt: eclectic Aristotelianism. The strong Platonist element in his philosophy, as Schmitt has argued, actually places *Theoria analytica* closer to the Cambridge Platonists than is normally supposed.

Digby's opposition to Ramus highlights his special interest in Aristotelian logic, which has an important role in *Theoria analytica* where his epistemology combines Aristotelian syllogistic with Platonic dialectic. In this, the exercise of reason is conducted and enhanced by the formal processes of dialectic. Furthermore, his use of Aristotelianism is informed by contemporary sources, such as Jacob Schegk and Johannes Caesarius, and, especially the anti-Ramists Carpentarius and Nicholas Grouchy. The impressive array of sources notwithstanding, Digby's work is chiefly indebted to Jacques Charpentier (Jacobus Carpentarius), especially his *Platonis cum Aristotelis in universa philosophia comparatio* (Paris, 1573). Aside from the trivial fact that many of Digby's sources are quoted at second hand from Charpentier, this work gives us two important clues to the intellectual context in which Digby was writing. The first is the obvious one that in Charpentier Digby found an ally against Ramism. Charpentier was an outspoken critic of Ramus' method. The *Comparatio* is interrupted at various points to import discussions from previously published orations against Ramism. The second point is that the stance of his opposition to Ramism is a syncretic one. The *Comparatio*, though heavily weighted towards Platonism, is predicated upon an accommodation between Plato and Aristotle. Furthermore, the *Comparatio* is in fact a commentary on a Platonist treatise of the third or fourth century which incorporates elements from Aristotelianism and Stoicism. This is the *Didaskalikos* or *Epitome of Platonic Philosophy*, attributed variously to Alcinous or the Middle-Platonist Albinus.³⁴ The *Didaskalikos* is not as obscure a work as it might seem: it was printed in translation with Ficino's translation of Plato's Dialogues. There was a handful of editions in Greek throughout the sixteenth century, including printings with the works of Apuleius. As a summary systematization of Plato, the *Didaskalikos* is the closest thing the Renaissance produced to a handbook of Platonism suitable

³³ Here I think that both Shahn Akester and Neil Gilbert (cit. supra at n. 30) are mistaken.

³⁴ Latterly, John Dillon has reasserted the claim that Alcinous is the author of this work, not Albinus. See the introduction to his translation, *The handbook of Platonism* (Oxford, 1993).

for Bachelors of Arts.³⁵ I will consider the further implications of Digby's anti-Ramism and his use of the *Didaskalikos* after I have said a few words about my other Elizabethan Platonist, Thomas Jackson.

THOMAS JACKSON

In the year of the founding of Gresham College, Thomas Jackson entered Corpus Christi as a scholar.³⁶ He came from Queen's College where he had studied for a year with the Aristotelian logician, Richard Crakanthorpe. In 1599, two years after he entered the college, John Rainolds took over as president. To its humanist tradition Corpus had added theological distinction in the persons of John Jewel and Richard Hooker – and, later, Rainolds too. Jackson's writings consist of twelve books of theology which together constitute a set of commentaries on the Apostles' creed. His Platonism is first expressed in a work entitled *The Eternal Truth of Scripture*, published in 1613 and based on his lectures at Pembroke Hall. Jackson was recognised as a Platonist by his contemporaries, especially his enemies, among whom William Twisse wrote:

I muse not a little to see Platonically and Plotinically Philosophy so much advanced by an Oxonian: as if Aristotles learning left logicians perplexed in a point of sophistry and only Plotinically Philosophy would expedite them.³⁷

As I have argued elsewhere, Jackson's is a theological Platonism, very much in the mould of the Cambridge School: Plato is, for him, very much the 'divine' Plato.³⁸ He broadly accepts the idea of a *prisca theologia*, places emphasis on the power of human reason, and adopts an innatist epistemology. It might be added that Jackson's theology of grace aligns him with the Cambridge Platonists whose views on the subject are not dissimilar from his Arminian position. I shall return to this later. For the present I want to

³⁵ *Alcinoi Philosophi Elementa atque initia*. The *Didaskalikos* was first translated into Latin by Pietro Balbi, and published in Rome in 1469 as an appendix to his edition of Apuleius. The translation was included in the 1561 edition of Ficino's Plato. It was first published in Greek by Aldus Manutius, in an edition by Francesco d'Asola. A new edition by Aresenius Aposklides appeared in 1535, and Denis Lambin (Lambinus) published the text with translation in Paris in 1567. It is often printed as an appendix to Apuleius (for example, in 1594 and 1688). The first printing in England was by John Fell in 1667, whose edition reproduces that of David Heinsius (1607). Thomas Stanley translated the *Didaskalikos* for inclusion in his *History of Philosophy* of 1667, in which it appeared as 'The Doctrine of Plato Delivered by Alcinous'.

³⁶ Jackson's contemporaries at the college included Brian Twyne, Daniel Featley, John Hales, Thomas Anyan and Henry Jackson – the last two subsequently devoted themselves to publishing Hooker's remains.

³⁷ W. Twisse, *Discovery of Doctor Jackson's Vanity* ([Amsterdam], 1631), p. 179.

³⁸ S. Hutton, 'Thomas Jackson, Oxford Platonist, and William Twisse, Aristotelian', *Journal of the History of Ideas* 39 (1978), pp. 635–52.

emphasize a feature of Jackson's Platonism which he shares with Digby: his accommodation of Aristotle.

RATIO HUMANA/LOGICA ARISTOTELICA

Jackson regarded Aristotle as inferior to Plato, on the grounds that Aristotle had less insight into matters divine. He regards him as a 'naturalist' but nonetheless a fine example of what human reason can achieve – within the limitations of human reason. Jackson is also generally critical of scholasticism. Nonetheless he draws on Aristotle and, like Digby, puts special emphasis on Aristotelian logic. Jackson's thorough knowledge of syllogistic reasoning is evident everywhere. In his first book, *Eternal Truth of Scripture* (London, 1613), Jackson condemns those who reject Aristotle:

it were a sign of ignorant arrogancy, if punies or freshmen should reject the axioms and principles of Aristotle, usual in the schools, because they have some reasons against them which themselves cannot answer.³⁹

I might add that Jackson ignores Ramism, employing instead the whole battery of Aristotelian dialectic. In this respect he can be seen to be a true pupil of Richard Crakanthorpe. An example of his insistence on close and accurate observation of the rules of dialectic can be found in a treatise entitled *The Primeval Estate of the First Man* (published posthumously in 1654), where he attributes the fractiousness of contemporary theological disputes to poor competence in logic. He claims that 'those unhappy controversies which have set the Christian world for these late years in combustion' have been stirred up by those who 'either never had faithfully learned any true logic, philosophy or ingenious arts, or else had utterly forgotten the rules which they had learned or heard, before they began to handle controversies in theology, or entertain disputes about them.'⁴⁰ Jackson then proceeds to apply this point to the then burning issue of the divine decrees.⁴¹ To prove his point Jackson treats his reader to a discussion of syllogistic logic which takes up most of chapter.⁴² Jackson seeks to expose the predestinarian arguments as fallacious. His strategy is at each stage of

³⁹ *Eternal Truth of Scripture* in Jackson, *Works* I (Oxford, 1844), p. 11.

⁴⁰ Jackson, *Works* IX, pp. 19–20.

⁴¹ For example, on the subject of God's hardening the heart of Pharaoh, Jackson argues that the reasoning of those who claim that God hardened the heart of Pharaoh eternally is fallacious; *ibid.*, pp. 470–72.

⁴² Jackson argues that God's hardening of Pharaoh's heart did not apply for all of Pharaoh's life (i.e. from infancy) but only to the time of his dealings with Moses. In his turn he marshalls syllogistic logic to argue that 'Pharaoh in his youth or infancy was not excluded by God's irresistible will from salvation', starting from the thoroughly Arminian major proposition that 'No man whose salvation as yet is truly possible, is utterly excluded by God's irresistible will from salvation'; *ibid.*, p. 486.

the argument to agree to a rule of Aristotelian logic, and then to deny its relevance to the case under discussion by invoking another Aristotelian rule. In taking on the predestinarians, he not only entered one of the most inflammatory religious controversies of the early seventeenth century,⁴³ but also levelled the charge of fallacious reasoning at the prince of the predestinarians, Theodore Bèze (Beza) himself.

Jackson's use of Aristotelian logic is testimony to the hold of Aristotle among the theologians of his time. It is certainly the case that other works of English theology of that date were normally Aristotelian or scholastic in their philosophical framework.⁴⁴ Jackson is unlikely to have invoked Aristotelian rules if he thought his reader was unfamiliar with them. It would certainly have been pointless to set the delights of Plotinus before the eyes of Puritan scholastics like Laurence Chaderton, William Twisse, William Perkins or Anthony Tuckney, never mind to try to combat their arguments in favour of supralapsarianism by recourse to Plato – that purveyor of 'Aegyptian darkness'. It is noticeable that Jackson invokes the rules of Aristotelian logic particularly for disputation, when he is combating opponents of one kind or another, in particular the hard-line predestinarian or the Roman Catholic polemicist.⁴⁵ We should not forget that the arts curriculum in Tudor and Stuart England involved a grounding in logic, a subject for which Aristotle's *Organon* was an essential text. No one could graduate BA, never mind proceed to the higher plane of DD, without a grounding in logic. All theological polemicists, therefore, were trained in the procedures of Aristotelian dialectic. But it was not just theologians who were so trained. Aristotelianism provided not just the framework of theology but of argument generally.⁴⁶

⁴³ See N. Tyacke, *Anti-Calvinists* (Oxford, 1987).

⁴⁴ Indeed, according to J.W. Binns, in his *Intellectual culture*, a specialist line in logical analysis of the bible can be detected in the late sixteenth century.

⁴⁵ Both, in Jackson's account, are pretenders to logic. Both resort to Aristotelian modes of argument. To show up a logical precisian (i.e. puritan) as violating the basic principles of logical reasoning is to beat the academic predestinarian with his own weapon.

⁴⁶ Although some of Jackson's writings deal with theological controversy, he does not direct his arguments solely at theologians. Another important assumed readership are the putative atheists whom he tackles in his book the *Treatise of the Divine Essence and Attributes* (1625). In doing so he employs the standard apologist's strategy of keeping the discussion within the opponent's terms of reference, in order to persuade him by arguments he is bound to accept. Jackson deliberately uses what he calls the kind of 'general maxim most in request with men of his profession' (*Works* V, p. 45); for example, '*Actus prior est potentia* "That which hath perfect being, is simply and absolutely before that which proceedeth from it, or is brought to perfection by it"' (ibid., pp. 252-3); '*Non licet transcendere a genere ad genus*' ('we cannot in demonstrating pass from one genus to another': *Posterior Analytics* 1,7. 75a39); '*actus agentium sunt in patiente bene disposito*': "The efficacy of every agent", saith the philosopher, "is in the patient fitly disposed to receive it".'

The context within which Jackson was writing was indeed predominantly Aristotelian, but we see in his writings at least two distinct facets of academic Aristotelianism. On the one hand there is the broadly humanist Aristotelianism and on the other there is scholastic Aristotelianism. The latter was particularly in request with certain types of theologian, and nurtured by the traditional study of logic. Although it is impossible to say whether the Platonic emphasis in Jackson's theological complexion may be attributed to the influence of any particular don at Corpus, it is the case that the college environment of his undergraduate years was one which admitted alternatives to Aristotelian dogmatism. The humanistic approach to learning evinced by Jackson is one he shared with the Corpus tradition as represented by Vives and John Rainolds. The Corpus tradition was one which combined respect for antiquity with a critical sense of the value and applicability of classical texts. In the case of Aristotle, such an approach meant rejecting him as an unquestioned authority, but utilizing his writings appropriately to the needs of the sixteenth-century Christian reader. Like Rainolds, Jackson names the Spanish humanist Juan Luis Vives as one of his chief mentors.

JUAN LUIS VIVES

As one of the first lecturers in humanity at Corpus Christi, Juan Luis Vives undoubtedly had a shaping influence on humanistic studies there. Although Vives had respect for Aristotle as a great pagan thinker, he refused to accept Aristotle's teachings as unquestioned dogma, proposing instead a wider range of classical sources and an *ad fontes* approach to studying them.⁴⁷ Vives recommends Aristotelian texts for the study of logic, but he is critical of much of Aristotle's writing on the subject for being obscure and impractical. For the study of dialectic, or the science of logical proofs, he recommended reading George of Trebizond, Giorgio Valla and Philip Melancthon prior to selections from Aristotle. His list of recommended reading also included Boethius, Martianus Capella, Apuleius, Poliziano and Greek interpreters of Aristotle rather than medieval commentators.⁴⁸ He is also critical of many aspects of Aristotle's natural philosophy. Vives advocates an experiential aspect in the study of nature: book learning (including Aristotle) alone is insufficient; it should be supplemented by examining nature at first hand and consulting those who live close to it, like gardeners and shepherds. Vives recommends Plato as a 'holy philosopher'. Although he issues a caveat about reading pagan authors, he notes that Plotinus, Proclus, Apuleius, Plutarch, Prophyry, Iamblichus and Michael Psellus all wrote on spiritual

⁴⁷ On Vives, see C.G. Noreña, *Juan Luis Vives* (The Hague, 1970).

⁴⁸ *De tradendis disciplinis* IV.1.

matters, and recommends Ficino for elucidating both Plato and Plotinus. Since Vives regarded theology as the highest and purest part of philosophy, his commendation of Plato for his insight into matters divine sets him (in Vives' estimation) above other classical philosophers.

JOHN RAINOLDS (1549-1607)

Jackson's respect for Aristotle as a great thinker from the past is consistent with the humanist approach to classical learning that he shared with John Rainolds, one of the first generation of the Aristotle revival in Tudor England.⁴⁹ Rainolds became president of Corpus Christi in 1599. He had in his turn been Greek Reader – a post he filled for six years from 1572–78. Rainolds is known today as an Aristotelian, and his lectures on Aristotle's rhetoric have now been published.⁵⁰ Critical though he was of scholasticism and of using Aristotle dogmatically, Rainolds himself lectured on Aristotle's rhetoric. Although an Aristotelian, Rainolds was far from being a brash Ramist revisionist. Rather, he rejected the Ramist critique of Aristotle. In an important article, James McConica has demonstrated that Rainolds represents a humanist tradition deriving from Vives, who had himself taught at Corpus Christi.⁵¹ Rainolds's humanist respect for classical learning and his Christian humanist critique of Aristotle are both clearly illustrated in his lecture *An Excellent Oration of the Late Famously Learned John Rainolds, DD ... very useful for all such as affect the Studies of Logick and Philosophie and admire profane learning*, originally delivered in 1573 and published in Latin in 1613 and in English in 1638.⁵² This oration testifies to Rainolds's admiration for the humanist and former lecturer at Corpus, Juan Luis Vives. It also bespeaks an awareness of Italian humanist debates and his dislike of logicians. His list of hates includes figures such as Richard Stanyhurst, Agostino Nipho, Paul of Venice, and Donato Acciaiuoli, whom he refers to as 'scum'. The lecture is specifically aimed at Aristotle's concept of the highest good, and those who esteem Aristotle unquestioningly. He claims to be

⁴⁹ Schmitt, *John Case*, p. 222.

⁵⁰ L. Green, *John Rainolds' Oxford lectures on Aristotle's rhetoric* (Newark, 1986). Rainolds was also one of the leaders of the more puritan members of the University of Oxford; J. Loach, 'Reformation Controversies', in McConica (ed.), *The Collegiate University*, p. 393.

⁵¹ 'Reynolds' perspective on Aristotle in the 1570s is the familiar outlook of the Christian humanist whose one desire is to fill the minds of the young, not with useless subtleties, but with a rich spectrum of pagan wisdom, ready to be turned by those who understand it properly into harmonious instruments for a good life. It is pagan wisdom conveyed through Christian filters': J.E. McConica, 'Humanism and Aristotle in Tudor Oxford', *English Historical Review* 94 (1979), pp. 291–317.

⁵² The Latin version was published in *Iohannis Rainoldi olim Graecae linguae praelectoris in Collegio Corporis Christi apud Oxoniensis Orationes Quinque*, ed. Henry Jackson (Oxford, 1613). John Leycester's English translation was published in Oxford in 1637.

following Vives and Peter Martyr in his assessment of Aristotle, and points to Pomponazzi as an example of the kind of danger that results from 'listening too much to Aristotle'. Rainolds's condemnation of Aristotle has to be put in the context of a cautious attitude to philosophy generally: he notes that Ficino 'became superstitious' from reading Plato, and that the 'vild and gracelesse' Cornelius Agrippa and Nicholas Machiavelli have 'polluted all Italy' with their philosophy.

However, this does not mean that Rainolds condemns either philosophy or Aristotle outright. 'I neither contemne nor condemne the study of Philosophie', he writes, but only, 'the enemies of the Faith [that] lie couched under the name of Philosophy'.⁵³ To proscribe profane books, Rainolds argues, is to proscribe the likes of Aristotle, Plato, Cicero and Demosthenes, and to prevent us from obtaining knowledge of 'History, Philosophy, Eloquence'. 'The scriptures and profane writings', he says, 'are like Hippocrates' twins laughing together, weeping together, sicke together, and sound together'.⁵⁴ And he cites as examples Protestant universities (Geneva, Leiden, Basel, and German universities) where scholasticism has been banished, in contrast to Paris and Padua where impiety reigns. Apart from the insight that this lecture gives us about how Tudor Oxford saw itself in relation to European academies, this oration is particularly interesting for my purposes because Rainolds explicitly links his approach with the traditions of the college by invoking the name and aims of its founder, Richard Fox. Also, in his *Orations*, Rainolds's references to Plato are on the whole complimentary. Any reservations that he has fall within the category of the good Christian's wariness of merely human learning.⁵⁵ Although Rainolds shows no leanings to Platonism in his lectures on Aristotle's *Rhetoric*, he quotes from or refers to several of Plato's dialogues: *Alcibiades*, *Apology*, *Gorgias*, *Ion*, *Laws*, *Phaedrus*, *Republic*, *Theages* and *Timaeus*. His references to Plato are largely positive: Plato ranks along with Cicero and Cato as 'the most learned, most eloquent and most excellent of men'.⁵⁶ Understood within a broad humanist spectrum, Rainolds's Aristotelianism was, arguably, tolerant of Platonism.

⁵³ Ibid., p. 122.

⁵⁴ Ibid., p. 125.

⁵⁵ Rainolds's criticism of Aristotle on theological grounds is also echoed in Jackson's critique of Aristotle. It also appears that Jackson did not share Rainolds's evaluation of Ficino. However, it is known from his book list that Rainolds possessed copies of Ficino, Plato and Plotinus. It is also the case that Vives recommended Ficino as an interpreter of Plato and Plotinus in his *De tradendis disciplinis*.

⁵⁶ Rainolds, ed. Green, p. 377.

JACKSON AND DIGBY

Both Jackson and Digby were products of leading foundations of humanist learning in Tudor England. They shared a preference for Platonist metaphysics while accepting Aristotelian dialectic. In this respect their Platonism is grafted onto a branch of learning well-established in the Tudor academies. Their syncretic approach to ancient philosophy facilitated this kind of accommodation, which was undoubtedly nurtured by a humanist approach to antiquity. There is one other circumstance which they share, and which sets their Platonism in close relation to Cambridge Platonism, and that is the theological context. In both cases there is a link between Platonism and anti-Calvinism which anticipates a pattern of theological preferences to be found among the Cambridge Platonists, all of whom accepted a liberal doctrine of grace which aligns them with the Dutch Arminians. Digby's anti-Ramism is accompanied by (and is perhaps a manifestation of) an opposition to the puritan ascendancy within the University of Cambridge. He was deprived of his fellowship by the hard-line Calvinist Master of St John's, William Whitaker, an ally of Laurence Chaderton. Digby's other writings suggest he was in the same theological camp as Richard Hooker. His Platonist metaphysics is therefore associated with a more liberal theology than that of his opponents. Similarly, Thomas Jackson's Platonism underscores an anti-Calvinist position in theology. He was to become the most important theologian of the Church of England in the time of Archbishop Laud.⁵⁷ Jackson's 'Arminianism' sets him apart from John Rainolds, who was leader of the reforming (puritan) wing of the English Protestantism at Oxford and an opponent of such theological liberals as Antonio Corro. Jackson's Arminianism, and perhaps his Platonism too, can be explained as a straightforward reaction to the severe Calvinism of Rainolds, and perhaps also to his clear commitment to Aristotle on the academic front. But before seizing on this easy explanation, we should remember that Corpus nurtured other theologians of liberal temper, notably that proponent of a *via media*, Richard Hooker. (Two fellow undergraduates of Jackson's subsequently devoted themselves to publishing Hooker's remains: Henry Jackson and the future President of Corpus, Thomas Anyan). Besides, as I have already argued, Rainolds's Aristotelianism was not antithetical to Platonism.

One further, and unexplored, connection between the Tudor Platonism of Digby and seventeenth-century interest in Platonism is the epitome of Platonism I mentioned earlier: the *Didaskalikos* of Alcinous. As far as I am aware, Thomas Jackson makes no reference to this, although it exemplifies the kind of syncretic approach to Aristotelianism and Platonism to which he subscribed. But Digby's interest in Alcinous' *Didaskalikos* was shared by

⁵⁷ Hutton, 'Thomas Jackson, Oxford Platonist', *Journal of the History of Ideas* (1978).

mid-seventeenth century English classicists: it was translated into Latin by John Fell in 1657 and into English by Thomas Stanley for inclusion in his *History of Philosophy* (1657). Furthermore, Charpentier's commentary is cited by the Cambridge Platonist, Ralph Cudworth, in his *Treatise Concerning Eternal and Immutable Morality*, published posthumously in 1731 but written in the 1660s. The *fortuna* of the *Didaskalikos* is a topic that has still to be explored in detail. But it is worth noting that when investigating the fortunes of 'Platonism' it is important not to be restricted by too narrow a view of what constitutes Platonism. Texts that we would not nowadays consider mainstream must be considered, and it is sometimes also useful to consider clusters of texts.

An interest in Platonism was certainly not confined to the leading humanist foundations. Humanism, after all, was wide-reaching in its impact. Tolerance of Platonism alongside acceptance of Aristotelianism can be seen elsewhere, within the broader framework of humanist respect for antiquity.⁵⁸ And here Gresham College is, perhaps unexpectedly, an instructive example. The metaphysical Platonism of Digby, Jackson, Cudworth and More is a far cry from the down-to-earth curriculum which has come to be considered the hallmark of Gresham College. Among the professors of divinity there is no one noted as a Platonist. Nonetheless, it is striking that eight of the nine professors of divinity appointed between 1597 and 1660 were graduates of the University of Cambridge: two from Queen's College, three from Trinity, and one each from King's, St John's, and Emmanuel (the exception is Osbaldstone whose educational background is not mentioned). Several of them can be characterized as anti-Calvinist. The second, Hugo Gray, was suspected of Socinianism; the fourth, George Mountayne (Montaigne), later Archbishop of York, was an enthusiastic supporter of Laud. This is not enough to secure a link between Gresham divinity and the Platonists of Oxford and Cambridge, though the charge of Socinianism is one that sometimes indicates Platonist leanings.⁵⁹ The professor for whom the record of lectures is most complete is Richard Holdsworth (1590-1649); the theological profile that emerges from his Gresham lectures is striking for its humanism. Like Everard Digby, he was a scholar of St John's College, Cambridge. He

⁵⁸ It should not, of course, be forgotten that even the most scientific of the Gresham professors had a training in humanist learning. And in some cases, their humanist expertise was of the highest order. John Greaves, who was appointed Gresham Professor of Geometry in 1630, travelled to Turkey and Greece in search of Greek manuscripts. Isaac Barrow, Gresham Professor of Geometry in 1662, had been appointed Regius Professor of Greek at Cambridge in 1659. John Ward, *The lives of the professors of Gresham College* (London, 1740), pp. 137-53 and 157-67.

⁵⁹ S. Hutton, 'The Neoplatonic roots of Arianism' in *Socinianism and its role in the culture of the seventeenth and eighteenth centuries*, ed. L. Szczucki (Warsaw and Lodz, 1983), pp. 139-45.

was appointed Gresham Professor of Divinity in 1629, and was subsequently appointed Master of Emmanuel College, Cambridge (1637) and Vice-Chancellor of the University of Cambridge (1640-43). Holdsworth was a fierce defender of academic independence, with the result that he suffered at the hands of both the King and Parliament. He was in fact imprisoned by Parliament from 1643 until 1645, when he was deprived of his mastership of Emmanuel College, and replaced by the Calvinist, Anthony Tuckney. Holdsworth's opposition to Parliamentary interference at Cambridge, and his support for the King, whom he attended at Hampton Court in 1647, did not, however, prevent him being elected Queen Margaret Professor of Divinity there in the same year.

Holdsworth's *Praelectiones theologicae habitae in collegio Greshamensi* were published posthumously in 1661 by his nephew, Richard Pearson. These consist of two sets of lectures, which, according to the *DNB*, were originally delivered to crowded audiences. The first set of lectures forcefully defends the use of pagan authors in theology. Holdsworth's arguments are judicious, putting the opposing case prior to his own. But his line is one which shows that he, like Jackson, accepted that pagan wisdom contained traces of ancient theology, *prisca theologia*:

In respect of philosophy: in the writings of the ancient philosophers, the traces and characters of many doctrines of faith are to be found, with which the writings of Moses and the prophets are suffused ... On the unity of God many things can be found in Pythagoras, Archytas, Empedocles, Parmenides, Zeno, Plato, Aristotle, Homer, Hesiod, Aratus, Plotinus, Porphyry. From others not a few things about the creation of man, the immortality of the soul. And things not to be condemned about those good and evil angels can be found in Orpheus, Menander, Empedocles, the Chaldean Oracles, Plato and others.⁶⁰

As this quotation shows, Plato appears in the context of a broad range of classical wisdom, including Aristotle. Holdsworth's admiration for Plato *in rebus divinis* is, however, clear. He calls Plato 'the most divine of philosophers' ('Philosophorum divinissimus Plato'), and cites him at the opening of at least four of his lectures.⁶¹ Aristotle is accorded no equivalent recognition. It is worth recording that Holdsworth is not just an example of the

⁶⁰ 'Quod ad Philosophiam; reperiuntur in veterum Philosophorum scriptis reliquiae quaedam & characteres multorum Fidei dogmatum, quae ipsi e Moses & Prophetarum scriptis suffusati sunt; atque vel illa humano ad Deum gradu promovent, quia paucula quaedam de Deo remantur. De Unitate Dei peti nonnulla possunt Pythagora, Archyta, Empedocle, Parmenide, Zenone, Platone, Aristotele, Homero, Hesiodo, Arato, Animae; atque de ipsis Angelis bonis & malis non contemnenda ex orpheo Menandro, Empedocle, oraculi Chaldaicis, Platone, aliisque'; Holdsworth, *Praelectiones theologicae habitae in collegio Greshamensi apud Londinenses a Richardo Holdsworth, S.T.D.* (London: James Flesher, 1661), p. 62.

⁶¹ *Ibid.*, p. 359, and lectures 8, 14, 24 and 41.

liberal humanism of St John's College fostering admiration for Plato. He is also a tangible link between the humanism of St John's and the Platonism of Whichcote, Cudworth and John Smith, all of whom were students or fellows at Emmanuel College while Holdsworth was Master of the same college.⁶²

The fact that Holdsworth was also Professor of Divinity at Gresham College means that there is more of a link between Gresham and the Platonist humanism of Cambridge than has ever been supposed. Besides, the connection between Gresham and Cambridge is a parallel of a different sort: the relationship between a school of thought and its institutional origins. Just as the humanist educational foundations of early Tudor England bore fruit in the humanist Platonism of inter-regnum Cambridge, so also the educational provision of Gresham College fed the new science of the seventeenth century. Half a century lapsed between the founding of Gresham and the emergence of the new science of Hooke and Boyle. The humanist foundations of Henrician England did not bear Platonist fruit for a century and more. Co-incidentally, Cambridge Platonism flourished in exactly the period that saw the emergence of the new science institutionalized by the founding of the Royal Society.

⁶² It must be said, however, that to judge by the 'Directions for a Student in the Universitie' (c.1640) attributed to him, Holdsworth is unlikely to have introduced his students to the study of Plato, since this stipulates no text by Plato or any Platonists. It is printed in H.F. Fletcher, *The intellectual development of John Milton* II (Urbana, Ill., 1956), pp. 623ff. See also, J.A. Trentman, 'The Authorship of "Directions for a Student in the Universitie"', *Transactions of the Cambridge Bibliographical Society*, 7 (1978), pp. 170-83.

Testimonia humanitatis: the early lectures of Henry Savile

Robert Goulding

Nearly a quarter of a century after Thomas Gresham provided a home for the mathematical sciences in London, Henry Savile (1549-1622) put geometry and astronomy on a similar footing in Oxford, by founding a chair in each of these subjects. When he endowed the chairs in 1619, three years before his death, he drew up an eminently sensible set of statutes, governing the appointment of the lecturers and their duties, both research and teaching.¹ Their research, Savile writes, should, above all, comprise the study of classical Greek mathematics, although they should not neglect modern advances. The professors themselves, however, should not remain content with explicating and illustrating the work of others, but should try to develop and enlarge their disciplines - in the case of the professor of astronomy, by nightly celestial observations. To this end, they must deposit their findings in the library for the use of future professors, just as Savile had done with his own notebooks. As a research programme, Savile's specifications carefully balance scholarly, humanistic studies with mathematical specialization - specialization that requires, though only to a modest degree, familiarity with mathematical practice. Among his professors' teaching responsibilities, Savile again makes most provision for the exposition of the theoretical part of the disciplines - yet he does not, by any means, neglect practical mathematics.

The professor of astronomy's primary teaching duty is to expound the entire *Almagest* of Ptolemy, supplementing it with Copernicus, as well as with other works ancient and modern. In addition he must - if the University will grant him the time - teach his students the whole of optics, the design and construction of sundials, geography, and 'those parts of navigation which are founded on mathematics'.

The professor of geometry also should teach subjects beyond the conventional, pedagogical bounds of his discipline. He must lecture on all thirteen

¹ The statutes are reprinted in *Statuta antiqua Universitatis Oxoniensis*, ed. S. Gibson (Oxford, 1931), pp. 528-40. The following paragraphs are summarized from pp. 528-9 and § 5 on p. 531.

books of Euclid's *Elements*, the entirety of Archimedes' works and the *Conics* of Apollonius. In addition, the professor is to teach his students *geodaesia* (or 'practical geometry'), music and mechanics. Perhaps as a comment on the abilities of the average Oxford undergraduate of the time, Savile directs the professor of geometry to teach, at least once a week, simple arithmetic in his rooms, in English if necessary. If this were not enough, he stipulates finally that the professor should 'at suitable times, convenient to him, demonstrate the practice of geometry to those of his students who wish to attend, in places around town or in the nearby countryside'.

I do not want to overstate Savile's enthusiasm at this time for practical mathematics. Aubrey tells the well-known story of Savile interviewing the unfortunate Gunther for the position of the first Savilian Chair of Geometry.

So [Gunther] came and brought with him his Sector and Quadrant, and fell to resolving of Triangles and doeing a great many fine things. Said the grave Knight, *Doe you call this reading of Geometrie? This is shewing of tricks, man!* and so dismisst him with scorn, and sent for Henry Briggs, from Cambridge.²

This episode, however, perhaps reveals more about Savile's irritable nature than about his considered opinion on the merits of practical mathematics. The Savilian statutes show that, at least in more temperate moments, he acknowledged a place for the applications of mathematics – if only as useful, concrete tools for instilling in youth the underlying, theoretical sciences.

This is Savile's mature, down-to-earth blueprint for scientific education at Oxford, and in it can be recognized aspects of Savile's programme that were shared by Thomas Gresham. But it is interesting to contrast Savile's sober balance between theoretical and practical mathematics in his statutes, with the altogether more hot-headed convictions of the youthful Savile half a century before, at his first lectures in 1570; and it is these that I should like to examine in this paper. Savile was just 20 years old, but was already an old Oxford hand. He had matriculated at Brasenose College in 1561 at the age of 11, and at the age of 15, without even a bachelor's degree yet in hand, he was elected a Fellow of Merton College.³ In 1570 he was a freshly minted regent master, deputized by his fellow masters to teach the ordinary lectures on astronomy – the exposition of a text to undergraduates. This was

² O. L. Dick (ed.), *Aubrey's brief lives* (London, 1958), p. 268.

³ For general biography on Savile see M. Feingold, *The mathematicians' apprenticeship* (Cambridge, 1984), pp. 124–31; H. W. Garrod, 'Sir Henry Savile: 1549–1949', in J. Jones (ed.), *The study of good letters* (Oxford, 1963), pp. 101–19; R. Goulding, 'Henry Savile and the Tychonic World-System', *Journal of the Warburg and Courtauld Institutes* LVIII (1995), pp. 152–79; J. R. L. Highfield, 'An autograph manuscript commonplace book of Sir Henry Savile', *Bodleian Library Record* VII (1963), pp. 73–83.

the only formal teaching of astronomy provided at university level at Oxford, although Savile did expect his students to have already attended ordinary lectures in arithmetic for three terms and geometry for two, according to the laws of the university.⁴

Savile's Latin notes for the lectures occupy three volumes densely written in his own hand. When he founded his professorships, he donated these notebooks, along with the rest of his mathematical library, to Oxford University. The Savilian Library was absorbed into the Bodleian Library last century; the lecture notes are now MSS Savile 29, 31 and 32.

University records tell us of the reluctance of some regent masters to undertake ordinary lectures,⁵ and there is some banter in Savile's first lecture, where he assures the audience that, despite rumours to the contrary, he truly was pleased that he had been given the task.⁶ Indeed, he seized the opportunity to go beyond the customary elucidation of a text. Despite being, as he put it 'an ordinary lecturer, that is, almost less than nothing',⁷ he took it upon himself to restore mathematics at Oxford to its ancient dignity.

His course of lectures was unusual even in its length. In the very first lecture, Savile anticipated 'a year of half-hours' spent with his students on the text of Ptolemy's *Almagest*.⁸ But the 'set text', as it were, was only a starting point for extended digressions, and the note he placed against one of his later lectures - 'first lecture of the ninth term' - indicates the course had gone considerably beyond its intended duration.⁹ It is difficult to estimate how long the entire lecture series lasted, but the first volume, MS Savile 29, seems to contain about three-and-a-half years' worth of lectures. The remaining volumes contain compressed, mathematical notes interspersed with fully written-out introductions and conclusions to a handful of the lectures, and must represent at least a year's further lectures.

⁴ Oxford, Bodleian Library MS Savile 29, fol. 9r: 'cum [auditores mei] sint, aut esse debeant, et extitisse sperem, qui tres terminos Arithmeticae, duos geometricae, cum publicis in scholis, tum privatis meditationibus fructuose impenderint.' ('Since my audience have, or should have (and I hope they have) completed to good effect three terms of arithmetic and two of geometry, not only attending public lectures but also pursuing private study.') On ordinary lectures in general, see A. Clark, *Register of the University of Oxford*, II, Oxford Historical Society Publications X (1887), pp. 95-9; J. M. Fletcher, 'The faculty of arts', in J. McConica (ed.), *The history of the University of Oxford* III (Oxford, 1986), pp. 157-99, esp. pp. 185-7.

⁵ See for instance Fletcher, 'The faculty of arts', in McConica (ed.), *History of the University of Oxford* III, pp. 157-99, esp. pp. 185-8.

⁶ MS Savile 29, f. 2v.

⁷ MS Savile 29, f. 3v: '... ut praelector ordinarius, id est paene minus quam nihil ...'.

⁸ MS Savile 29, f. 3v: '... tantum polliceor, quantum munus hoc annuum, et brevissimum semihorae praestitutum spatium, et occupationes privatae patientur.' ('I promise as much as a year's course, the very short allotted time of half an hour and personal duties will allow').

⁹ MS Savile 29, f. 109r: 'Lect. 1^a : nonus terminus'.

The lectures begin with a long exhortation to the study of the mathematical sciences in general. Savile then praises each of the sciences individually: arithmetic, geometry, music, optics, mechanics, astronomy and geography. At the end of the last of these protreptic lectures, on geography, he promises his audience that he will begin the following day with an exposition of Ptolemy.¹⁰ Overnight, however, he seems to have had a change of heart; for the next lecture instead begins a history of astronomy and mathematics, from Adam to Ptolemy. These historical lectures occupy sixty-eight pages of the volume – some 40,000 words – and recount the lives and works of 154 astronomers and mathematicians. By the time he reaches the life of Ptolemy, Savile worries, with good reason, whether he will ever complete the exposition of his text within the allotted time; setting aside this ‘talkative mathematics’ (*garrula mathesis*) he turns to his text in earnest.¹¹

He skips quickly through the early chapters of the *Almagest*, perhaps having little patience now for Ptolemy’s own *garrula mathesis*. Once he reaches the properly mathematical part of the text, however, his rate of progress drops back again. Savile at this point reveals the novelty of his approach to Ptolemy. For example, as well as explaining the ancient astronomer’s spherical and trigonometrical methods, he summarizes the principal theorems in Regiomontanus’s *De triangulis* and other, contemporary, writers’ works.¹² He draws on the ancient commentary of Theon in order to explain ancient methods for calculating with sexagesimal numbers, and appends several modern methods as well.¹³ Of most interest for historians, however, is that when he comes to planetary theory, he supplements each of Ptolemy’s constructions with the corresponding Copernican mechanism, and uses the astronomical works of Regiomontanus to expound the theoretical principles behind both sets of hypotheses.¹⁴ In short, Savile’s lectures are less a strict commentary on the Ptolemaic text than an encyclopedic survey of the theory and practice of astronomy from antiquity to his own day.

The lectures attest to an enormous amount of reading and study on Savile’s part. I should like to pause for a moment here and recount just how it was that Savile attained such an education in both the history and the practice of mathematics. Savile tells his students that it was in the second year of his studies that, immersed in the works of Euclid, Ptolemy and

¹⁰ MS Savile 29, f. 25^r.

¹¹ MS Savile 29, f. 65^r and the addition to this page on f. 1^v.

¹² MS Savile 29, ff. 83^r ff.

¹³ MS Savile 29, ff. 73^r–77^v.

¹⁴ MS Savile 31, f. 6^r on the solar theory; MS Savile 32, fols 8^v–9^r introducing the theories of the superior planets and Venus; fols 9^v–10^r introducing that of Mercury. Much of MS Savile 32 is devoted to applying the methods of Copernicus, Ptolemy and Regiomontanus in turn to planetary problems.

Archimedes, he experienced a sudden insight into the beauty and harmony of theoretical mathematics. 'My soul was flooded with intense pleasure, and I sought nothing else in the way of utility or diversion.'¹⁵ Such emotive, almost mystical outbursts are found throughout the lectures. In a later lecture he says: 'I am passionately inflamed with love for geometry. Even here, even now, I can barely restrain my tumultuous emotions.'¹⁶

A slightly more prosaic account of the process by which Savile became immersed in ancient and modern mathematics is found in his manuscript notebooks from the period of his MA, 1566-69.¹⁷ In these volumes Savile made a Latin translation of the first Greek edition of the *Almagest*, of 1538, and the commentaries by Theon, Pappus and Cabasilas that were published with this edition.¹⁸

Appended to this manuscript translation is an invaluable document: Savile's list of several hundred *Auctores mathematici*, including ancient, medieval (both western and Arabic) and contemporary writers on all the mathematical sciences.¹⁹ The amount of detail given for each varies, but Savile tries to provide brief bibliographical information on each author, a list of both his published and, where possible, unpublished works, sometimes also giving the location of the manuscripts. To compile this enormous repertorium, he used Diogenes Laertius' *Lives of the Philosophers*, augmented by other ancient and humanistic histories, for the ancients; the massive bibliographies of Gesner for printed books, and of Bale for British authors. To fix the dates of many of his *auctores* he plundered the chronological sections of Caspar Peucer's astronomical handbook, the *Elementa*.²⁰

Savile cites one source in particular in dozens of his entries: Peter Ramus's *Prooemium mathematicum* of 1567.²¹ This work, an exhortation to mathematics by one of Europe's most controversial philosophers, also includes a history of the discipline, beginning, as in Savile's case, with the first human beings, but extending right up to the author's own day. In Savile's list

¹⁵ MS Savile 29, f. 5^r: '... ut altero iam anno quo animum ad discendum inieci, et in Euclidem, Ptolemaeum, Archimedes praecipue incubui, prope incredibili perfusus animi voluptate, nihil extra quaesiverim vel ad utilitatem vel ad oblectationem.'

¹⁶ MS Savile 29, f. 10^v: 'Geometriae tamen amore intemperanter ardeo, nec immoderatos hoc loco eos impetus facile cohibeo.'

¹⁷ MSS Savile 26-8.

¹⁸ *Kl. Ptolemaïou megales syntaxeos bibl.* 13..., Basel, 1538. Transliterations from the original Greek here and henceforth are set in italic font for clarity.

¹⁹ The list begins on f. 28^v; ff. 29 to the end of the manuscript have been renumbered, starting from 1. I refer to what originally was, say, f. 30, as f. *2, using the new numbering.

²⁰ On the rear flyleaf of MS Savile 28, Savile has listed 'Gesneri bibliotheca, Diogenes Laertius, Peuceri Sphaerum, Prooemium Mathematicum', and has written Ramus's name elsewhere on the page. An example of his use of Gesner is the entry for Ioannes Blanchin, on f. *2^v, which is a direct summary of C. Gesner, *Bibliotheca universalis* (Zurich, 1545), ff. 389^v-390^r.

²¹ Petrus Ramus, *Prooemium mathematicum* (Paris, 1567).

of *auctores*, his entries for scientists still working in Europe are almost entirely drawn from this work.

To complete our picture of Savile's mathematical education, the Bodleian Library holds several printed books that Savile annotated in this period. As we would expect, there are copies of Euclid and Archimedes in Greek, and the works of Regiomontanus, their margins filled with Savile's dense notes. (Unfortunately, Savile's copy of Ramus cannot be traced, nor can his Copernicus.) He paid equal attention to Proclus' *Commentary on the First Book of Euclid*, a work that provided him with many historical insights, valuable information on ancient geometrical problems and, most importantly, a Platonist view of the nature of mathematics.²²

Such exhaustive reading formed the basis of Savile's lectures of 1570. I have already mentioned the strictly mathematical parts of his lectures, in which he made use of ancient commentators, Regiomontanus, Copernicus and much else to explicate Ptolemy's astronomy. I want to look more closely now at Savile's introduction to Ptolemy: his exhortation to mathematics, and his descriptions of the mathematical sciences. It is here that he expressly tells his audience what to expect from the study of mathematics, and also tells *us* much about his audience.

The undergraduates who attended the first lecture on 10 October 1570, had no idea, of course, how long Savile would take to cover all thirteen books of the *Almagest*. The passionate rhetoric of their lecturer's exordium might have given them some clue that his ambitions ran far beyond imparting the elements of the 'sphere' and the use of an almanac:

When Aristippus, the Socratic philosopher, was shipwrecked on the shore of Rhodes, he found that his small band of companions in that same ill-fortune and peril were greatly afraid; some feared that, although they had survived the waves and had thought that they were out of danger, they would now starve to death in a forsaken land; others, having braved the rocky, barbarous sea, trembled at the thought of beasts more terrible than any storm; and still others shuddered with fear of meeting men more dangerous than any beasts, human only in appearance. But Aristippus saw, drawn in the sand – that sand which can never be praised enough! – some mathematical diagrams, and took it as a very great sign of hope for them all. 'The greatest dangers and wildest storms are now past', he said. 'Look in the sand, my friends, and see the calculations. See the circles, triangles, squares, polygons; in my misery the contemplation of them delights me, raises my spirits in my depression and consoles me in my suffering. I can tell you – not as an augur from the birds, not as a soothsayer from entrails, not from the stars as an astrologer (and

²² Savile W.9(1) is *Eukleidou Stoikheion bibl. ie'*; *Eis tou autou to proton egegematou Proklou bibl. d'*, Johannes Hervagius (ed.) (Basel, 1533); Savile X.9(1) is Archimedes, *Opera quae quidem extant omnia* (Basle, 1543). Savile W.11(4) is Iohannes Regiomontanus, *In Ptolemaei magnam compositionem ... epitome* (Nuremberg, 1555).

never have I regretted my ignorance of *the* occult mysteries) – but as, perhaps, a prudent judge of our situation, I can prophesy from these drawings in the sand your safety and the end of all your miseries. These figures are tokens of humanity, and are no small mark of Greek learning. Believe me, my friends, the study of these arts is incompatible with a savage mind; these arts are noble and are learnt by noble men. Nor can anyone embrace the liberal arts unless he is liberally educated. Have high hopes for the character of these islands; those who know how to ‘geometrize’, know how to show mercy.²³

The story of Aristippus originally appeared as a brief anecdote in the *De architectura* of Vitruvius, in the preface to book VI. Many of the phrases in Savile’s exordium, however, echo Ramus’s retelling of the story in his *Prooemium*.²⁴ But Savile gives an ethical interpretation to the story that is lacking in Ramus: those who know geometry, know how to show mercy. To find *this* interpretation, we must turn to Philip Melanchthon’s introduction to Iohannes Vöglin’s *Elementale geometrica*, first published in 1528. When Aristippus spotted the diagrams on the beach, says Melanchthon:

he told his companions to be of good heart, saying he had seen the footprints of men, and was glad for himself and the others because they had not been washed up onto some barbarous shore; and he assured them that humanity towards shipwrecked strangers would not be wanting in men who cultivated the study of these arts.²⁵

²³ MS Oxford, Bodleian Library, Savile 29, f. 2^r: ‘Socraticus Aristippus, cum ex naufragio Rhodiorum ad littus proiiceretur non multis comitatus eiusdem periculi fortunaeque sociis, pertimescentibus caeteris, partim ne sibi qui superatis iam fluctibus omni se molestia defunctos arbitrabantur, nova necessitas instaret in agro deserto fame pereundi, partim ne pelago iam usi scopuloso atque barbaro, bestiis uterentur deinceps aestu quovis immanioribus, et partim ne in homines inciderent belluis infestiores, nihil humani praeter faciem habentes; primus conspectis mathematicorum diagrammatis et illo numquam satis laudato pulvere ad bene sperandum de salute omnium quasi signum aliquod amplissimum extulit. Maximas molestiarum moles et turbulentissimas tempestates effugimus. En illum, comites, pulverem et abacum. En circumductos circulos, descripta trigona, tetragona, polygona, quorum me contemplatio maerentem delectat, iacentem erigit, afflictum excitat. Non ego vobis, ut augur ab avibus, non ut aruspex ab extis, non a stellis, ut astrologus, quorum occultis mysteriis carere me non moleste fero, sed ab hisce depictis formulis, ut non imprudens forte rerum aestimator, salutem et miseriarum omnium finem denuntio. Figurae sunt humanitatis indices, graecae disciplinae non leve vestigium. Mihi credite, comites, harum artium studia in animum agrestem non cadunt. ingenuae sunt, ab ingenuis discuntur, nec quisquam, nisi liberaliter institutus, liberales artes complecti potest. De moribus insularum bene sperate. Sciunt misereri qui sciant *geometrein*.’

²⁴ p. 318.

²⁵ The preface was reprinted in Philippus Melanchthon, *Mathematicarum disciplinarum tum etiam astrologiae encomia* (Strasbourg, 1537); sig. B3^r: ‘... iussit socios bono animo esse, inquiens se vidisse hominum vestigia, gratulatusque est sibi et reliquis, quod non in barbarum littus eiecti essent, confirmavitque humanitatem erga hospites ac naufragos non defuturam illis hominibus, apud quos harum artium studia colerentur.’

Melanchthon goes on, and this is the point of the anecdote, to complain that no such signs of humanity are now found in the universities.²⁶ Savile uses the story to make the same point: 'How I wish that, just as Aristippus predicted accurately about the Rhodians, so too could I guarantee to myself, on the basis of the same signs, the humanity of the men of Oxford.'²⁷ Indeed, we shall see that Savile did not hold a high opinion of the state of mathematical learning at the Oxford of his time.

The early lectures are filled with many other verbal echoes of Ramus's *Prooemium mathematicum*, from isolated phrases to entire sentences copied *verbatim*.²⁸ Clearly Savile had the work before him as he wrote; he even gave the same title – *Prooemium mathematicum* – to his own lectures. But despite the fact that he had used this popular introduction as a source both for his *auctores mathematici* and his lectures, Savile had little sympathy with Ramus's philosophy of mathematics. After presenting his own Platonizing view of mathematics as a purely theoretical science (which will be examined below), Savile attacks Ramus for his practical approach to geometry and arithmetic.

I wish, Ramus, that you had followed Plato, Ptolemy, Proclus, and other philosophers more learned than yourself and declared contemplation of the eternal realities to be the purpose of the most liberal of arts; instead you made the purpose of these arts mechanical and illiberal. No commoner can be a craftsman who is not seen more with a level and plumbline when building walls than you, a master of mathematics, are seen with Euclid and Pappus, although you have laboured for many years in this field. If only you had extolled the ascent to separated substances with your unique rhetorical gifts and had vigorously demonstrated your eloquence to us – now instead we despise it, immersed as it is in such baseness.²⁹

Ironically, Ramus himself, in the *Prooemium mathematicum* at least, had also shown traces of a Platonic influence. Moreover, Savile's notes from the period show that he had derived some of his Platonic ideas from Ramus's

²⁶ Ibid.: 'Vtinam vero haec hominum vestigia quae ibi in littore miratus est Aristippus, in scholis etiam frequentiora essent. Iacent enim desertae et neglectae hae artes multis iam seculis.'

²⁷ MS Savile 29, f. 2^r: 'Atque utinam quam est hoc vere praedictum ab Aristippo de Rhodiis, tam mihi certo ex iisdem signis de Oxoniensium humanitate possim polliceri.'

²⁸ Compare, for instance, MS Savile 29, f. 6^r: 'Eratosthenes, ut Eutocius ait ...' with Ramus, *Prooemium mathematicum*, p. 106; or MS Savile 29, f. 6^v: 'Physica illa quae dicitur ...' with *Prooemium*, pp. 199–200.

²⁹ MS Savile 29, f. 5^v: 'Hunc tu finem artium liberalissimarum, Rame, cum Platone, Ptolemaeo, Proclo, et reliquis doctioribus philosophis constituisses velim, non illum mechanicum et illiberalem: in quo cum multos annos elaboraris, nemo tamen erit artifex de vulgo, qui non plus in extruendis parietibus cum libella et perpendiculo videbit[ur], quam tu cum Euclide et Pappo mathematicus magister. Istam si tu pro tua singulari in dicendo facultate ad substantias separatas *anabasin* exornasses, et tuam nobis vehementer probasses eloquentiam, quam nunc quidem in tanta rerum foeditate contemnimus.'

text.³⁰ It is true, however, that in his *Geometria* Ramus had directed this art – the *ars bene metiendi* as he called it – almost entirely to the numerical solution of geometrical problems. Furthermore, in the *Prooemium*, Ramus subjected Plato's unrelenting high-mindedness to harsh criticism. 'I cannot praise Plato's position,' Ramus writes, 'Geometry is not contaminated, but rather adorned and honoured by mechanical applications. Mathematics will only be complete when its applications – the purpose for which it was invented – have been perfected.'³¹ Ramus blames the universities' neglect of geometry on Plato's 'blind ostentation': once the applications of geometry fell into disuse, no one could see the point of studying it.³²

Ramus's opinions were bound to offend Savile, who in these early lectures was just as high-minded as Plato. Many at Oxford were, in any case, very sceptical about Ramus's reductionistic philosophy, in which all the arts were simplified through the 'three laws of method' to conform to Ramus's pedagogical ideas – just as at Cambridge there many who were enthusiastic.³³ We know something of Savile's opposition to the Ramist method in later periods of his life, at least. While on his European tour in the 1580s, he confided to a friend that he found François Viète's *Canon mathematicus* disappointing because of its 'Ramist method', which, he said, was utterly worthless.³⁴ In 1583, shortly after his return to England, a letter from an Oxford undergraduate of the time records that Savile was widely tipped to be the university's champion in a refutation of the new philosophy as advanced by William Temple.³⁵ Finally, at the end of his life, Savile criticized

³⁰ Following the *auctores mathematici* in MS Savile 28, at ff. *44^v–*45^r, Savile has copied out a series of extracts from Ramus's *Prooemium mathematicum*, with page references to the 1567 edition. The extracts are headed 'de fine Rami', and concern the purpose of the mathematical sciences. Many made their way, often unaltered, into Savile's lectures. A series of extracts falls under the subheading 'The first use is for contemplation' ('Prima utilitas ad contemplandum'). Savile copies from Ramus the opinion that 'Mathematics is a path to learning, so that whoever learns mathematics can easily grasp the other arts' ('Mathematica kata paldousin bodos, ut qui mathematicam didicerit, possit reliquas artes facile perdiscere'). Savile cites this Greek phrase at f. 5^v as an example of the Platonic philosophy that Ramus had neglected.

³¹ Ramus, *Prooemium mathematicum*, pp. 73–6: 'Quod factum Platonis equidem laudare non possum ... Neque enim Geometria, ut verissime Pappus in mechanica disseruit, mechanicis operibus contaminatur, sed ornatur et honoratur, perfectaue tum mathematica esset et absoluta, quando perfectum et absolutum usum, id est, finem propter quem est inventa, consecuta esset ...'.

³² Ramus, *Prooemium mathematicum*, p. 124: 'Haec caeca Platonis ambitio, Geometriae non solum usum, sed scientiam ipsam paene perdidit.'

³³ H. Kearney, *Scholars and gentlemen. Universities and society in pre-industrial Britain 1500–1700* (London, 1970), esp. ch. 3.

³⁴ Goulding, 'Henry Savile', p. 175.

³⁵ MS Oxford, Bodleian Library, Rawlinson D.985, f. 52^v. Reprinted in R.W. Jeffery, 'History of the College: 1547–1603', *Brasenose Quatercentenary Monographs, Oxford Historical Society Publications* LIII, monograph X, p. 57.

the Ramist programme in his lectures on the first book of Euclid, characterizing the three laws of method as 'three slogans that even the Ramists themselves scarcely understand'.³⁶

Savile did find one point, however, on which he could agree with Ramus: his criticism of the poor state of mathematics at English universities. In 1565 Ramus wrote to John Dee, to tell him of his plans to write an introduction to mathematics and to ask him for some information on science in Dee's own country, especially at Oxford and Cambridge. Clearly, he did not receive a positive reply, for in the *Prooemium* he wrote:

But Elizabeth, Queen of England, do not allow your England to be a pupil of France any longer, but summon the French in their turn over to England. ... Inquiring into the two most erudite universities of your realm I have learnt that professors of Greek, Hebrew, medicine, civil law, and theology are honoured with royal stipends ... but no royal reward has been allotted for the professors of mathematics. ... And so for you, Your Majesty, I desire Regius Professors of mathematics in both Cambridge and Oxford, to adorn your memory with eternal praise for your magnificent generosity.³⁷

Drawing his students' attention to the 'recently published criticism' of the universities,³⁸ Savile, in his very first lecture, explains the reasons, as he sees it, for the decline of mathematics at Oxford.

To some extent he rings the changes on a humanist commonplace: the status of learning and its deterioration since classical times. He took as a model, in fact, a great mathematical humanist, Regiomontanus, who began his *Epitome in Almagestum* with just such a complaint. Regiomontanus writes that the inventors of the liberal arts were virtuous men, unconcerned with financial gain, and dedicated to their art for its own sake. The inevitable decline from this Golden Age set in when a desire for financial gain began to creep into men's minds. The eventual result was the terrible state of mathematical learning Regiomontanus found in his own age. Why then does no one make the effort to revive these arts? Mathematics, Regiomontanus explains, is commonly perceived to be very difficult, and so scholars are

³⁶ H. Savile, *Praelectiones tresdecim in principium Elementorum Euclidis, Oxonii habitae* (Oxford, 1621), p. 44: '... Methodistae cum suis bellis emblematis, *kata pantos, kath' hauto, katholou proton*, a seipsis parum intellectis...'

³⁷ Ramus, *Prooemium mathematicum*, pp. 55-9: 'At Elizabetha Anglorum regina, Angliam tuam Galliae discipulam diutius fieri ne sinito, sed Gallos vicissim in Angliam provocato ... In duabus eruditissimis regni tui academiis sciscitando didici regiis stipendiis honorari professores linguae graecae, hebraicae, medicinae, juris civilis, theologiae. ... At mathematicis artibus praemium regale nullum est constitutum ... Itaque opto regios reginae Elizabethae in academia et Cantabrigiensi et Oxoniensi mathematicos professores, qui sempiterna praeclarissimi beneficii laude memoriam tuam exornent.'

³⁸ MS Savile 29, ff. 2^v-3^r: 'quam quidem ingratham et adversam dignitati nostrae famam, scripta non iam pridem severa monitione auctam et amplificatam vidimus.'

unwilling to devote themselves to it. This is due to the intrinsic complexity of the subject matter and the poor state of the books, which in turn is the fault of translators incompetent both in classical languages and the sciences. In their *Epitome*, Regiomontanus and his teacher Georg Peurbach had not only produced a better version of the *Almagest*, he claimed, but had also given some thought to order and presentation, so as to make the work more suitable for the student.³⁹

We find similar reasons given by Savile to explain the decline of mathematics at Oxford, although they are tailored to his own time, and to the English context. Oxford, he says, is now more Attic than Athens herself, and the graduates of Oxford lead the world in eloquence, Greek, law and theology. But at one time, the whole of Europe looked to Oxford for instruction in mathematics, astronomy, physics – and now not a single student can be found with a grasp of even the basic elements of these disciplines. Why the neglect, indeed contempt, for these subjects? First, Savile says, the students are unwilling to study mathematics, not because of its difficulty, but because of its apparent uselessness. Then, the books which students of mathematics are set to study are wholly inappropriate – this is not the fault of the translators or authors, but of the teachers, who ‘day and night harp on at the same erroneous ideas’.⁴⁰ Finally, just as Regiomontanus had done, he sees the need for a more orderly treatment of mathematics. Only remedy these faults, he says, and

then indeed we shall have very many mathematicians. And not Oronce Finés as in France, nor Sebastian Münsters as in Germany, but Archimedes and Ptolemies, or rather Swinesheads, Bacons, Wallingfords, as there were in that long-ago Oxford so different from our own; and we shall make this university, already famous through its profession of so many of the liberal arts, by far the *most* famous through the addition of great mathematicians.⁴¹

It is Savile himself, of course, who has been given the opportunity of effecting this change in the fortunes of mathematics at Oxford.⁴² And, most significant, for the realization of this ambition he appeals to Oxford’s ‘Atticism’, and to the humanist education of its undergraduates.

³⁹ Iohannes Regiomontanus, *Opera collectanea* (Osnabrück, 1972), pp.59-61.

⁴⁰ MS Savile 29, f. 3^r: ‘... si denique magistri tradantur, non quidem eandem mendam diem noctemque tundentes, sed qui maximis tantum et obscurissimis difficultatibus lucem afferant interpretationis...’

⁴¹ Ibid.: ‘Nae permultos habebimus, non Orontios quales Gallia, non Munsteros quales Germania, sed Archimedes, Ptolemaeos, vel quales illud Oxonium huic nostro dissimillimum, Swinsetos, Bacones, Wallingfordos et Academiam per se ipsam tot iam disciplinarum professione claram, clarorum mathematicorum accessione longe clarissimam reddemus.’

⁴² Ibid.: ‘Sed O me somnio nescio quo felicem, qui hoc seculo, his hominum moribus scholis mathematicis dignitatem restituere sperarem.’

The drawings in the sand, Savile had told his students, were 'tokens of humanity' – 'humanitatis indices', indicating, literally, the existence of men and their 'humaneness', that is, their ability to show mercy. The word 'humanitas' could also mean a 'humanity', humane learning, or liberal art, and Savile interprets the word in this sense as well. The mathematical sciences, he says, are 'testimonia humanitatis', signs or testimonies of liberal learning.

For what can anyone achieve in the sciences, which desire to be, and to be considered, part of the humanities, what progress can anyone make, unless his mind is already prepared and moulded in the humanities?⁴³

There is evidence from this period that the 'humane mathematician' was not just an ideal to inspire his students. Savile's own work, in notebooks and the margins of printed books, reveal a classicist, a humanely learned man applying his skills to the recovery of ancient mathematics. For example, Savile annotated in this period a printed book containing, in Greek, the late antique commentary on Aristotle's *Physics* by Simplicius.⁴⁴ The commentator had preserved an important fragment on the history of geometry by the pre-Euclidean writer Eudemus. Eudemus described the three quadratures of the lune, or crescent-shaped figures formed from arcs of two circles, which were discovered by Hippocrates of Chios. Only one of these was known in medieval accounts of the problem, or indeed in more sophisticated sixteenth-century works. Savile's Aldine edition of the Greek Simplicius was, in this section at least, very corrupt and in places unintelligible. The copious annotations in Savile's copy show that he collated the printed text with a New College manuscript which provided some superior readings. The text was still far from perfect, but Savile was able to employ mathematical reasoning to restore the constructions and proofs, then work back to the text, supplying plausible emendations that reflected his reconstruction of Hippocrates' thought.⁴⁵ Savile emended the text of Archimedes in much the

⁴³ MS Savile 29, f. 2^r: 'Quid enim in hisce nostris studiis, quae humanitatis esse et haberi volunt, quid aget animus humanitate non praeparatus et quasi informatus?'

⁴⁴ Simplicius, *In octo libros Aristotelis Physicae auscultationis libros* ..., Venice, 1526. The Bodleian copy with Savile's annotations is Savile P.10.

⁴⁵ See T. L. Heath, *A history of Greek mathematics* I (Oxford, 1921), pp. 182–200; M. Clagett, *Archimedes in the Middle Ages* I (Wisconsin, 1964), pp. 610–26. The simplest lune was constructed on a right-angled isosceles triangle, and its quadrature was known throughout the Middle Ages. Eudemus (in Simplicius' summary) relates that Hippocrates had also squared two differently-shaped lunes which were constructed on two trapezia constructed according to a definite proportion. The geometry is not straightforward, and it is here that Simplicius' (unillustrated) text becomes most opaque, and Savile had to apply all of his philological and mathematical skills. Johannes Buteo, *De quadratura circuli libri duo, ubi multorum quadraturae confutantur, et ab omni impugnacione defenditur Archimedes* (Lyons, 1559), pp. 17–22, was the most authoritative contemporary account of the quadrature

same way, although here he had several manuscripts to consult, as well as good Latin translations.

It would be difficult, of course, to find a mathematician from this period who was not humanistically educated. Mathematicians were still recovering the legacy of Greek mathematics, and the new philological techniques of the humanist were indispensable. The students of Oxford certainly shared with Savile this humanistic training – in fact, as Savile complained, it was often *all* they had. If mathematics could be made interesting to them, then there was no reason, he thought, why they could not excel in this field as well.

Savile attempted to arouse his students' interest in two principal ways: first, he introduced the mathematical sciences as historical disciplines; and second, he argued against the prejudice that mathematics was a tool of merchants, instrument-makers and sailors. Savile's extensive history of mathematics exemplifies the first point. He weighs up and judges conflicting biographical sources, puts mathematicians into their context as figures of the ancient world and, most important, shows that contemporary mathematicians are not concerned with obscure novelties, but are instead reviving the methods and concerns of antiquity. In his life of Aristarchus, for instance, Savile praises Copernicus as a reincarnation of the ancient astronomer, who has restated for the present age a classical discovery that was in danger of being forgotten.⁴⁶ Other astronomers are mentioned for their learning in Greek. He describes Erasmus Reinhold as a man 'born to advance mathematics and deeply read in Greek literature', and praises him for his insights into the text of the *Almagest*.⁴⁷ As an example of the historical problems that might confront his students, Savile considers the identity of Euclid, and shows that he could not have been the disciple of Plato, as was universally

of lunes, but nevertheless described only the first. The manuscript of Simplicius that Savile employed was MS Oxford, New College, 244.

⁴⁶ MS Savile 29, ff.46^v–47^r: '... crederem profecto, si pythagorica *metempsychosis* mihi probaretur, animum Aristarchi multa secula vagantem in corpus commigrasse Copernici. ... et quamvis ex suis ipse scriptis Aristarchus non potest cognosci ... eadem fere dicit [Archimedes] de astrologia Aristarchi quae sunt a Copernico nuper in caelo confirmata. Itaque caelum hoc copernicianum novum quoddam inventum non est, cum quadringentis ante Ptolemaeum annis sit ab ingeniosissimo artifice constabilitum...' ('If I accepted the Pythagorean doctrine of reincarnation, I should believe that the soul of Aristarchus, having wandered many centuries, had migrated to the body of Copernicus. ... And although it is not [now] possible to read Aristarchus's writings, ... Archimedes says almost the same things concerning the astronomy of Aristarchus as were recently affirmed in the heavens by Copernicus. And so this Copernican heaven is not some new invention, since it was established by a brilliant master four hundred years before Ptolemy.')

⁴⁷ MS Savile 29, f. 64^r: 'Erasmus Rheynholdus, vir ad amplificanda mathemata natus, et graecis libris eruditus'.

believed – Commandinus came to the same conclusion in a work published two years later.⁴⁸

What is most striking about Savile's lectures, however, are his arguments against practical mathematics. His careful study of Proclus' *Commentary* on Euclid had implanted in him the Platonist view that while mathematics may well have some application to everyday life, its true worth lies in allowing us a glimpse of the eternal, unchanging world of the Forms. In comparison with this, all practical uses, all worldly concerns in fact, pale into insignificance. He quotes a passage from Proclus, in which the philosopher likens the study of mathematics to release from Plato's cave. Plotinus, Alcinous and Ptolemy himself are all brought in to attest that mathematics is a 'path to theology', and that its ultimate end is the 'immediate contemplation of Being'.⁴⁹

Savile's professed Platonism in his apology for mathematics is, in a sense, conventional. It was a commonplace of Continental introductions to mathematics to adopt this lofty view of the sciences. It should also be kept in mind that Savile's exclusive support for theoretical mathematics may have been encouraged by his desire to be as different as possible from Ramus. Indeed, he castigates Ramus for his practical concerns, and exclaims: 'Immortal gods! That mathematics – until now immune from all thoughts of worldly advancement – should be reduced to a mere mechanical skill, as though thrust into some lowly mill!'

The mind born for philosophy delights in mathematics solely through contemplation, and is not enticed by any external reward; in fact, true mathematicians are unaware even of hunger or thirst when they are absorbed in these pleasures.⁵⁰

Whether or not Savile was being entirely genuine when he defended mathematics in this way, there is no doubt that Platonism informed his judgement of what he thought was worth studying in the sciences and his view of what the sciences were for.

There are, of course, practical uses for every branch of mathematics. But, he remonstrates,

⁴⁸ MS Savile 29, f. 41^r; F. Commandinus, *Euclidis Elementorum libri XV* (Pesaro, 1572), sig. *5^r.

⁴⁹ MS Savile 29, f. 5^v.

⁵⁰ MS Savile 29, ff. 5^v–6^r: 'Dii immortales, mathesin quae hucusque ab omni vitae commodo sacrosancta fuit ad mechanicae tractationem tanquam vilissimum aliquod pistrinum detrudi! ... siquidem sola contemplatione non allectus ullo externo emolumento animus ad philosophiam natus mathematicis delectatur, et in his tractandis facile venit in oblivionem omnium commoditatum ad vitam pertinentium. imo qui vere mathematici sunt, dum his voluptatibus indulgent famem aut sitim non sentiunt...'

how false would be my hope, listeners, and how pointless my mental labours, if so many wearisome days, so many wakeful nights, so many difficulties in learning mathematics, are to sink back into the consideration of mechanics alone. Euclid would certainly not have kept me up so many sleepless nights, if I had only wanted to learn how to measure a tower; nor would I have exerted myself so in understanding the discoveries of Archimedes, if I had only sought to be an architect; nor would it have been necessary both to understand and interpret you, Ptolemy, if I had only wanted to build an astrolabe, or foretell the future.⁵¹

Savile later does relent, and admit that mathematics may be admirable for its 'extreme effects, where it mingles with matter'; but the examples he gives are, in fact, drawn from logic and physics, and not from practical mathematics.⁵² Later, when he examines geometry, he praises it as the queen of all the mathematical sciences, the source from which all the others flow. To the accusation that it is useless in everyday life, he gives a rather ambivalent response:

I tell you, my audience, ... that there is nothing in the whole curriculum of learning (excepting the three faculties of law, medicine and theology) that provides such assistance to life, in so many and such extraordinary ways. And although, due to a sort of disgust for external things, my mind has always shrunk from consideration of this subject, I shall nonetheless point out the sources and origins of these applications, leaving a fuller discussion of these things to another time or, better still, another lecturer.⁵³

When Savile turns to astronomy, it is Platonism and the contemplation of divine mysteries that again dominate his praise of this science.⁵⁴ 'According to Plato, the Homer of philosophers', he says, humans were created 'to contemplate the marvellous structure of the universe and the coordinated harmony of all things'. Savile sees, in every detail of the received world-view, evidence for divine providence. The earth occupies the central point of the

⁵¹ MS Savile 29, f. 5^r: 'O spem nostram (auditores) fallacem, et cogitationes inanes, si exhaustae tot dierum molestiae, tot noctium vigiliae, tantae comparandis mathematicis difficultates in unius mechanicae tractationem recasurae sint. Equidem nec Euclides mihi unquam tot noctes insomnes duxisset, si ab eo nihil expectassem praeter turriculae dimensionem, nec in intelligendis Archimedis inventis tantos labores excepissem, si nihil aliud quaererem, quam ut Architectus esse possem, nec tu Ptolemaee duplicem et intelligendi et interpretandi molestiam facereres, si illud tantum spectassem, ut astrolabum conficerem, de futuris divinarem.'

⁵² MS Savile 29, f. 6^v.

⁵³ MS Savile 29, f. 11^r: 'Ego tamen vobis audientibus ... clare pronuntio nihil esse in toto encyclopaedia, si a tribus illis supremis iuris, medicinae, theologiaeque christianae facultatibus semel discesseris, quod tot, tam multiplici in genere, tam magnifica conferat ad hanc vitam adinventum. Et quanquam ab huiusmodi commemoratione nescio quo rerum externarum fastidio semper animus meus abhorruerit, digitum tamen ad fontes intendam, et unde manent omnia, demonstrabo, uberiores exornationem velim aliud tempus, vel in alium professorem reiciens.'

⁵⁴ The following is summarized from MS Savile 29, ff. 18^r-19^v.

universe; this is to avoid the effects of parallax which would otherwise confuse our celestial observations. The earth is large enough for human habitation, but still is only a point in comparison with the heavens; this is so that the greatest possible portion of the sky – one half – may be seen at any given time. In this way we are presented with an endless and constantly changing variety of heavenly phenomena.

But, he goes on, we are not meant just to admire the beauty of the stars. God put the stars in the heavens to stimulate the part of our souls that distinguishes us from the animals: our reason – and although we must take the first steps ourselves, the Creator left us plenty of hints to suggest the direction in which we should start walking. The central problem of astronomy is to explain the apparently random wanderings of the planets. To make these movements apparent to the primitive observer, God only had to provide one or two fixed stars as a stationary reference point. But, instead, He filled the heavens with countless stars, grouped into the forms of men and animals, so that planetary movement would be even more obvious, and so that it could be conveniently recorded. God placed our nearest neighbour, the moon, so as to exhibit a regular pattern of phases: a simple phenomenon with a simple explanation, but finding the explanation was the first step towards mathematical astronomy. The moon is also close enough to us to be susceptible to parallax. Since this presents the astronomer with great difficulties in formulating an accurate lunar theory, it might seem to be a poor decision on the Creator's part. But through the problem of parallax astronomers discovered the distance of the moon from the earth, and from there began to speculate on the size of the universe itself.

Savile adduces many more examples which all lead to a single, striking conclusion: that astronomy was not invented for the stars, but the stars were made for astronomy. The whole universe is a giant puzzle provided by the Creator for humans to solve. The very complexity is meant to arouse our sense of wonder – according to Aristotle, the root of all arts. Perhaps, he hopes, his listeners will be moved to the careful study of astronomy by the same marvellous phenomena that spurred the ancients to its first invention.

We should not, of course, expect that Savile entirely believed every step of his argument. This was, after all, a public speech, and as a good humanist Savile knew it was his task to entertain his listeners with his ingenuity, as much as to educate them. To some extent he is elaborating upon ancient models, particularly Plato's *Timaeus* and Cicero's *De natura deorum*. We have no reason to doubt, however, his faith in the thoroughly conventional idea that the universe was ordered by God, and that its regularity is evidence for the existence of a Creator, and in the corollary that astronomy leads one closer to an apprehension of divine providence and guidance than any other science.

But what kind of astronomy does Savile imagine will lead to the contemplation of God? 'By astrology', he says (and he uses the term interchangeably with astronomy),

I mean that art which demonstrates the forward and retrograde motions and revolutions of the planets and fixed stars. I do not mean that thing that most people call astronomy, which consists of drawing circles and illustrating by examples. When I see this practice, I am so far from the contemplation of divine providence, so far from wonder at divine workmanship, that I marvel only at the shameless vanity of those who are satisfied with acorns when fruit is available.⁵⁵

Savile's criticism is directed at the conventional teaching of astronomy found in medieval handbooks such as Sacrobosco's *Sphaera* and the *Theorica planetarum*, still used as university textbooks during the Renaissance. Savile sees astronomy as the exercise of reason on a class of perplexing, but orderly phenomena. The handbooks, on the other hand, provided only a simplified account of the final theories, with no indication of the steps required to reach the planetary model. Savile goes on to make a forceful statement – perhaps too forceful, since he later deleted it: 'The foundations of divine care and providence are laid in Ptolemy and Copernicus; in other authors, the foundations of ignorance.'⁵⁶

Savile has told his students that there is one kind of astronomy that they *might* have been expecting to be taught: the astronomy of the handbooks, but which he does not consider worthy of his attention. But he found an even more pernicious doctrine hiding under the title of astronomy or astrology:

But neither shall I offer any praise to the baseless belief in divination, which binds God to the stars, and through the signification of the stars, subjects Him to its own powers. This superstition is truly a curse, completely hostile to the idea of Providence, and must be rooted out entirely from Christian states – with the exception of some universally accepted signs read from the sun and moon. ... This I know for sure, that these men, who have grown so fat on their rewards that astrologers almost seem to outnumber good men, have never been approved by Holy Scripture – on which the Christian life should be based – nor by any theologian of any importance.⁵⁷

⁵⁵ MS Savile 29, f. 20^v: 'Astrologiam autem eam intelligo, quae progressus, regressus, conversiones luminum errantium fixarum[que] demonstrat, non eam quam plerique solam esse opinantur, qua circuli definuntur, describuntur, exemplis illustrantur, quae cum video, tantum absum ab ea quam extuli providentiae cogitatione, tantum ab admiratione fabricae divinae, ut nihil pene admirer, quam eorum impudentem vanitatem, qui frugibus inventis tantopere glandibus delectarentur.'

⁵⁶ Ibid.: 'Administrationis divinae providentiaeque iacta sunt in Ptolemaeo et Copernico fundamenta. in aliis ignorationis.'

⁵⁷ Ibid.: 'Sed neque illa divinandi temeritas, quae deum sideribus alligat, siderumque per significationem suae facultati subiicit, in huius societatem laudis ac communionem admittetur.'

The rejection of judicial astrology was one of the constants of Savile's life. Many more times in these lectures, in his speech before the Queen in 1592,⁵⁸ even in his lectures on Euclid, delivered near the end of his life,⁵⁹ he dismissed astrology as both baseless and impious, and he prohibited the two Savilian Professors from practising the art.⁶⁰

After dismissing these useless aspects of astronomy, Savile begins his exposition of the practical uses of the science with a thoroughly conventional series of anecdotes from the ancient historians, illustrating the value of astronomy in keeping time, and recounting the military disasters that resulted from generals' ignorance of, for instance, the length of a night in which a covert attack was planned.⁶¹ Turning, only briefly, to navigation, he places it in the same lowly position with respect to theoretical astronomy as surveying bears to geometry, or practical to speculative arithmetic. While not denying that theoretical astronomy is essential for the navigator, Savile regards the explorations of Columbus and Vespucci as advances in *theoretical* mathematics rather than specifically in navigation. Quite an exaggeration, of course, but in line with his conviction that the sciences are to be studied for their own sake; advances in theory may sometimes lead to unexpected practical benefits, but theory must always come first. He is also wildly over-optimistic when he states that longitude may 'easily' be discovered from the position of the moon. He closes this section, and reveals something of the interests of his Oxford audience, by promising not to linger any longer on the topic of navigation, 'which I know most of you despise'.⁶² He moves on, instead, to subjects closer to the Oxford curriculum: the use of astronomy in medicine and in the interpretation of the classics.⁶³

In a concluding passage, Savile expands upon the distinctively humanistic idea that the practice of astronomy consists in the recovery of, and elabora-

Pestis est illa profecto, providentiae inimicissima, et e christianis rebuspublicis - si katholika quaedam ex sole et luna prognostica excepis - penitus extirpanda superstitio. ... Illud certe scio, genus hoc hominum, quod in tantum munerum excrevit, ut plures pene sint Apotelesmatici, quam boni viri, nec sacris scripturis, ad quas vita christianorum instituenda est, ne ullo magni nominis theologo unquam probatum fuisse.'

⁵⁸ The text of this speech is reprinted from MS Oxford, Tanner 461, ff. 169 ff., in C. Plummer, *Elizabethan Oxford*, Oxford Historical Society Publications VIII (Oxford, 1887), pp. 263 ff. Savile judged a debate, deciding for the affirmative position on the question: 'Should astrologers be banished from the state?'

⁵⁹ Savile, *Praelectiones*, pp. 22-7.

⁶⁰ Gibson, *Statuta*, p. 529: 'Genethliacorum vero doctrinae et totius in universum divinatricis astrologiae sibi penitus noverit interdictam professionem.'

⁶¹ MS Savile 29, ff. 21^v-22^r.

⁶² MS Savile 29, ff. 22^{r-v}: '... ne semper haeream in navigationibus, quas scio plerosque vestrum contemnere ...'

⁶³ MS Savile 29, ff. 22^v-23^r.

tion upon, ancient models. Geometry, he says, is the fountainhead of the mathematical sciences; astronomy, on the other hand, is the final goal, absorbing from all the other sciences their best points. In fact,

these were so marvellously and artfully encompassed by Ptolemy that anything you might add to his synthesis would not be astronomy, and anything you removed would impoverish the art. But someone will say, did Copernicus not add something to astronomy? And what about the countless other books written about astronomy? All the others I would not hesitate to reject out of hand. For what is in all these little books on the sphere that is not already treated much more abundantly and clearly in Ptolemy? As for Copernicus, he has indeed earned immortal fame; but he has not added anything new to astronomy that was not already thoroughly discussed by Ptolemy. Instead, he has clarified the same problems by a new method and with different hypotheses. Neither man adds anything to the other's discoveries; both transmit the art in its entirety, even if based on entirely different principles.⁶⁴

This conservative humanism is all that Savile had to tell his students on the relative merits of the two systems. Even though these lectures did so much to introduce Copernicus into Oxford, this was a question that Savile would only begin to consider during his European tour.⁶⁵ Savile goes on to discuss in detail each of the parts of Ptolemaic astronomy, but it is on this note, appropriately linking the astronomies of antiquity and the present, that we leave Savile's protreptic to the sciences.

It is interesting to compare Savile's lectures on Ptolemy with those which his close friend John Chamber gave in 1573. Chamber copied all of his mathematical material from Savile's lectures, only linking the calculations and diagrams together into coherent discourses. In the introduction to his lectures on Ptolemy, Chamber again benefits from Savile's researches, and takes his anecdotes, and much of his argument, from Savile's description of astronomy, and the early pages of the history.⁶⁶ He ignores completely the

⁶⁴ MS Savile 29, f. 23^r: '...quos ita miro artificio complexus est Ptolemaeus, ut quicquid addideris illud astronomicum non sit futurum; quicquid detraxeris, tantum tibi sit de totius artis integritate deperitum. Quid igitur, inquiet aliquis, nihilne adiecit Copernicus, nihil tot de astronomia perscripti libri? Caeteros quidem omnes non dubitabo mea sententia condemnare. Quid enim tot sphaericis libellis continetur, quod non extet apud Ptolemaeum multo uberius, multo illustrius? Copernicus, quem laudes immortales meruisse constat, non aliquod novum caput ad astronomiam adiecit, quod non esset a Ptolemaeo pertractatum, sed ipse easdem res nova quadam ratione variatis hypothesis illustravit. Non adiecit quicquam alter alterius inventis, sed uterque, etsi longe alio instituto, totam artem tradidit.'

⁶⁵ Goulding, 'Henry Savile', passim.

⁶⁶ A part of Chamber's lectures is found in MS Savile 30. The Bodleian catalogue attributes this manuscript to Savile, but the hand can be identified as Chamber's from other examples in the Bodleian Library. The very first, similarly protreptic lecture is not included in this volume, but was published by Chamber in Latin and English under the title *Astronomicae encomium*, as an appendix to his *A Treatise against Iudicial Astrologie* (London, 1601).

practical applications of mathematics; the Platonism that dominated Savile's account, however, is reduced by Chamber to a paragraph or two at the end of his speech. Chamber allots a far more central place to the utility of mathematics in interpreting the ancient poets and historians and in the practice of medicine. He uses only those of Savile's examples which can be found in popular school texts, especially Cicero, Livy and Pliny. Although his introduction is less interesting than Savile's, Chamber has perhaps judged more finely what would appeal to young humanistically trained students, attending Oxford not with the aim of becoming great textual scholars, or devoting their lives to the study of Ptolemy's astronomy, but with their sights set on chancery, or medical practice, or a living in the Church.

After fifty years, the Savile of these lectures, so hostile towards practical mathematics and innovation, became the Savile who set down his admirable, balanced research programme for future scholars. It is perhaps not necessary to explain a change of opinion over such a long life; although it seems trivial even to mention it, the simplest reason is experience. The young Savile had received only the most rudimentary formal mathematical education. Nothing is known about any informal instruction that he may have received, especially from his friend, at least of later years, Thomas Allen, but his notes from this early period reveal someone who was self-taught. He consulted, moreover, only classical works and contemporary Continental textbooks. In his early notebooks he had noted Ramus's descriptions of the Alexandria of the north, the court of Wilhelm, Landgrave of Hessen-Cassel, and must have been disappointed by the comparison between Oxford and the Europe which nurtured new 'Archimedes and Ptolemies'. Rare for anyone in England at the time, he had read, and understood, the whole of Copernicus, a feat which required a grounding in so much of the science of antiquity. This, above all, was what Oxford lacked, and his programme for the revival of science at Oxford in his early years has some points in common with his mature ideas: at the base of both was the absorption into the university curriculum of the achievements of the ancients, and the study of theoretical sciences for their own sake. Soon after he had finished his lectures, he travelled in Europe for five years, for the first time meeting those modern Archimedes and Ptolemies that he had read of with such admiration - and discovered that they did not make such a rigorous separation between theory and practice. Half a century of teaching must have shown him, as well, that unworldly Platonism, or even philological humanism, is not the best recommendation for the sciences.

The visitor to Savile's great monument in Merton College chapel is first struck by the four imposing figures - Ptolemy, Euclid, Tacitus and St John Chrysostom - who flank him. Savile gazes serenely ahead, while they, the ancients who benefited from his scholarship, seem to marvel at their fortune in finding such an accomplished patron. These great statues indicate

Savile the scholar, the textual critic, the humanist and the theologian. It is some time before one notices the small painted panels: one depicting a navigation around the Cape of Good Hope, and the other showing astronomers scanning the heavens with cross-staffs. It is, it seems, in the combination of the theoretical and the practical that Savile finally saw Oxford's future in the sciences.

‘No small force’: natural philosophy and mathematics in Thomas Gresham’s London

Stephen Clucas

In his influential 1940 article on Gresham College, F.R. Johnson noted that

The opening of Gresham College was the culmination of a long effort in Elizabethan England to bring about the establishment of a permanent endowed foundation which would offer instruction and further research in the mathematical sciences and provide a convenient rallying point for all who were concerned with promoting progress in the practical application of these sciences to useful works.¹

While this institutional development marked a significant moment in the social construction of the mathematical sciences, we should not forget that Sir Thomas Gresham’s public endowment marked an investment in a new epistemological advance in mathematics, one which both revealed and concealed its origins in new socio-economic realities.² Gresham’s posthumous promotion of ‘progress’ in the ‘practical application’ of mathematics was made possible (or thinkable) by a profound epistemic shift in the discipline of mathematics which involved the theoretical overcoming of the centuries-old alienation of mathematical and physical entities in natural philosophy. Given the force of Aristotelian strictures on the transplantation of mathematical laws into other disciplines,³ and the Platonic (and

¹ Francis R. Johnson, ‘Gresham College: precursor of the Royal Society’, *Journal of the History of Ideas* I (1940), pp. 413–38, 423.

² On the involvement of the London merchant community and the City of London authorities in funding public mathematical lectures see Francis R. Johnson, ‘Thomas Hood’s inaugural address as mathematical lecturer of the city of London’, *Journal of the History of Ideas* III (1942), pp. 94–106 (95–7). See also Mordechai Feingold, *The mathematicians’ apprenticeship: science, universities and society in England 1560–1640* (Cambridge, 1984), esp. ‘Gresham College and its role in the genesis of London science’, pp. 166–89. On the origins of the relationship between nascent capitalism and the new mathematics in the early modern period see Frank Swetz, *Capitalism and arithmetic: the “new math” of the 15th century* (La Salle, Ill., 1987).

³ See Steven J. Livesey, ‘The interrelationship of the sciences in Antiquity and the Middle Ages’, PhD, University of California, Los Angeles (1982).

Neoplatonic) insistence on the ontological separation between the sensible and intelligible realms,⁴ how did the direct application of mathematical entities to physical entities become possible? What is an 'application', and how is this affected by the status of the entities involved?

In his account of the emergence of Galilean natural philosophy in his *Crisis of European sciences*, Edmund Husserl suggests that the sophisticated application of mathematical procedures to physical phenomena involved in mathematical physics was radically different from the kinds of application endorsed by Platonic metaphysics. At the beginning of the second part of his study of 'the Origin of the Modern Opposition between Physicalistic Objectivism and Transcendental Subjectivism', Husserl posits a question:

For Platonism, the real had a more or less perfect methexis in the ideal. This afforded ancient geometry possibilities of a primitive application to reality. [But] through Galileo's mathematization of nature, nature itself is idealized under the guidance of the new mathematics; nature itself becomes ... a mathematical manifold. What is the meaning of this mathematization of nature? How do we reconstruct the train of thought which motivated it?⁵

In her influential attempt to 'reconstruct the train of thought' leading from the mathematics of Renaissance magic to the mathematical physics of the scientific revolution in *Giordano Bruno and the Hermetic tradition*, Frances Yates saw the transition between the 'primitive application' of mathematical entities and the mathematical manifold of mathematical physics as relatively unproblematic. 'Renaissance magic', she said,

was turning towards number as a possible key to operations, and the subsequent history of man's achievements in applied science has shown that number is indeed a master-key ... to operations by which the forces of the cosmos are made to work in man's service.⁶

This statement - which assumes an easy and uncomplicated transition between 'magical' mathematics and 'scientific' mathematics⁷ - does not

⁴ See Edward W. Strong, *Procedures and metaphysics. A study in the philosophy of mathematical-physical science in the sixteenth and seventeenth centuries* (Hildesheim, 1966), ch. II, 'Metaphysical mathematics', pp. 15-46.

⁵ Edmund Husserl, *The crisis of European sciences and transcendental phenomenology*, trans. David Carr (Evanston, 1970), p. 23.

⁶ Frances A. Yates, *Giordano Bruno and the Hermetic tradition* (London, 1964), p. 146.

⁷ She does however concede that 'neither Pythagorean number, organically wedded to symbolism and mysticism, nor Cabalistic conjuring with numbers in relation to the mystical powers of the Hebrew alphabet will of themselves lead to the mathematics which really work in applied science.' She notes that 'within the scheme of magia and Cabala as formulated by Agrippa there was a place for genuine mathematical sciences.' Ibid., p. 147. However, this 'space' is not theorized, nor is the 'genuine' status of applied mathematics related to its magical counterpart.

negotiate the important debates concerning the nature of mathematic entities and their problematic relationship with natural entities in the late sixteenth century.

Edward Strong, in his study of the emergence of 'Mathematical-physical science' in the sixteenth and seventeenth centuries, *Procedure and metaphysics*,⁸ strongly resisted Edwin Burt's suggestion that Neoplatonic and Pythagorean mathematics directly influenced the mathematical physics of the scientific revolution.⁹ However, he equally strongly denies that there was any metaphysical or epistemological shift which preceded the emergence of mathematical science. Studying the mathematical work of the sixteenth-century French and Italian mathematicians Niccolò Tartaglia and Girolamo Cardano, as well as 'minor' mathematicians such as Girolamo Cataneo and Cristoforo Clavio, Strong concludes that it was not Neoplatonic or Pythagorean metaphysics which provided the stimulus for mathematical physics, but rather the 'procedures' and 'operations' of mathematics itself. Strong's vehemently internalist historical account suggests that Neoplatonic 'metamathematics' (as he calls it) is fundamentally *unmathematical*, which is to say, that it involves 'mystery and not measure ... classification and not mathematical structure.'¹⁰ In order to 'suit a metaphysical purpose', he says, 'mathematics was thrown into a status and assigned a role divorced from mathematical conception and meaningless for procedure.' Modern science, he insisted, 'established its method and achieved its results in spite of, rather than because of, this kind of metamathematical tradition'.¹¹ For Strong the procedures of mathematics are radically distinct from religious mysteries or metaphysical conceptions of the cosmos:

The demonstrative certainty of geometry lies in the nature of its logical formulation. Its use and certainty in physical investigation turns upon the exactness of physical determinations, and upon the ability of the investigator to know what principles are involved, what factors must be taken into account, what order, composition, and arrangement can be assumed without violence to the facts, what translations, formulations, and substitutions are to be made in order that mathematics may be applicable to physical problems, or in order that exact mathematical expression and demonstration can be given to physical processes.¹²

Apart from the obvious problems of anachronism (Strong is reading an extremely twentieth-century view of mathematical procedure into the ear-

⁸ See note 4 above.

⁹ Edwin A. Burt, *The metaphysical foundations of modern physical science* (London, 1932). See Strong, *Procedures and metaphysics*, pp. 4-9.

¹⁰ Strong, *Procedures and metaphysics*, p. 203.

¹¹ *Ibid.*, p. 217.

¹² *Ibid.*, p. 211.

lier period), Strong's account suffers from a failure to see the immanence of metaphysical assumptions in the procedures of mathematics. While Strong rejects the idea of 'metamathematical' influences on his selected mathematicians (whom he distinguishes rather artificially from the 'compilers or editors' of 'Neoplatonizing arithmologies and mathematical cosmologies')¹³ on perfectly good grounds, his account of how they arrived at their applications of mathematics to physical realities is problematic. Strong's argument is that the work of mathematicians on physical problems arose out of the nature of mathematics itself: their applications were 'working arrangements', a 'matter of method' which develops out of handling particular problems. While the procedures of mathematicians working on nature might be compatible with certain metaphysical principles, he says, this does not make the metaphysical principles necessary conditions.¹⁴ He attacks such arguments as *post facto* rationalizations by modern historians or 'philosophical interpreters of science': 'The "mechanical philosophy" emerges subsequent to the working distinctions when these distinctions are given an epistemological or ontological significance.'¹⁵ Such interpretations he saw as irrelevant and unjustifiable elaborations from mathematical and scientific practices.¹⁶ Mathematics is seen as a self-sufficient system, 'a procedure according to rule, a discipline of problem-solving, of exact demonstration, of theorem and proof.'¹⁷ This is undoubtedly the main flaw in Strong's argument: he sees mathematical-scientific practices as pre-theoretical and free of metaphysical assumptions. 'Concrete problems call forth new instrumentalities of methodological organization and control',¹⁸ Strong says, as if this 'calling forth' emanated from physical reality rather than theoretical intelligibility. There is no sense in Strong's work that procedures might *embody* certain metaphysical assumptions, or that practices might be pre-conditioned by theoretical considerations. Thus the 'translations, formulations, and substitutions [that] are to be made in order that mathematics may be applicable to physical problems' are seen by him as theoretically transparent, rather than the embodiment of the assumption that the translation or substitution of geometry and physical reality is actually possible.

¹³ Ibid., p. 47. Strong's distinction between 'metamathematics' and 'mathematics proper' does not really work even in the case of his representative figures. See, for example, pp. 66-9 where he identifies, but suppresses or de-emphasizes the significance of, occult interests in both Tartaglia and Cardano's works.

¹⁴ Strong, *Procedures and metaphysics*, pp. 213-14.

¹⁵ Ibid., pp. 74-5.

¹⁶ Ibid., p. 55.

¹⁷ Ibid., p. 212. Cf. p. 57: 'The discipline of mathematics speaks for itself and has to be mastered in its own terms.'

¹⁸ Strong, *Procedures and metaphysics*, p. 50.

This paper examines the work of mathematical practitioners in London between 1570 and 1600 - the London of Sir Thomas Gresham and his College - in order to reveal a vital shift in the epistemic foundation of mathematics - a movement away from mathematical idealism, the prohibitions of *metabasis* and the restrictions of *medietas*, towards a mathematical 'realism' which saw a much more direct and immediate relationship between the mathematical and the physical. I maintain that this 'realism' does not involve an epistemological continuity with Neoplatonic metaphysics (as Yates suggests), neither do I see it as a theoretically transparent and metaphysically neutral set of practices and procedures 'called forth' by physical reality, but rather what Husserl calls 'the performance of the coidealization of the sensible plena,'¹⁹ a significant shift in the mathematician's relation to the mathematical entity. The primary focus here will be a comparison of the mathematical attitudes of one of Gresham's contemporaries, John Dee, and those of the next generation, represented by Thomas Harriot, whose respective mathematical works mark different stages in this 'performance'. Before I do this, however, it is necessary to consider some of the debates about mathematics and the 'mathematical sciences' which flared up in the second half of the sixteenth century.

The idea of applying mathematics to the physical world did not leap fully formed out of the forehead of the Renaissance natural philosopher. The medieval tradition of 'mixed mathematics' had made great advances in the application of mathematical demonstration to the sciences of optics, statics and astronomy. What distinguishes these earlier forays into mathematizing nature from those of the late sixteenth and seventeenth centuries is the difference in ontological status which was accorded to mathematical entities. Due to a mixture of the Aristotelian prohibition of *metabasis* from scholastic physics and Platonic-Boethian idealism in mathematics itself, many medieval thinkers persisted in the belief that the world of things and the world of abstract mathematical entities were separate and incommensurable. Attempts to model the world of natural phenomena using mathematical devices thus tended to be underwritten with ontological qualifications. Marshall Clagett, for example, noted the 'all-pervasive' fourteenth-century hypothetical device of 'ymaginatio' a 'kind of thought experiment or imaginative scheme constructed as if it existed in nature, with the purpose of illustrating basic theoretical ideas.' These schemes, Clagett emphasize, 'were usually not thought possible (and indeed I would say that many were clearly invented with the understanding that certain features of the real world were to be set aside).'²⁰

¹⁹ Husserl, *Crisis*, p. 38.

²⁰ Marshall Clagett, 'Some novel trends in the science of the fourteenth century', in Charles S. Singleton (ed.), *Art, science and history in the Renaissance* (Baltimore, 1967), pp. 275-303, 276.

This kind of tentative and provisional ontological status was particularly common in connection with the mathematical representation of astronomical phenomena in the late middle ages and early Renaissance, when it was commonly assumed that hypotheses were merely useful fictions.²¹ The suppositious nature of mathematical models did not seem to cause undue anxiety amongst astronomical practitioners, who took a relatively pragmatic view of the matter. Thus Giovanni Pontano, in his *De rebus cælestibus*, regarded astronomical circles and epicycles 'and all suppositions of this sort' as 'imaginary'. 'They have no real existence in the heavens', he said, 'they have been invented and imagined so as to let the celestial motions be grasped and to exhibit them to our sight.'²² While he allowed that these 'suppositions [are] ... endowed with a sort of divine virtue as far as teaching and demonstration are concerned', he also claimed that celestial geometry had 'far less reality in the sky than the lines traced in the air by the aruspex.'²³ These 'sensible representations' are useful to the understanding as a 'stepping stone when it begins its investigations', but ultimately the astronomer should reject 'all such combinations of imaginary spheres to fasten instead solely on numbers and their ratios, which are its proper objects.'²⁴ Lefevre d'Etaples in 1503 also asserted that geometrical astronomical models were 'almost entirely a matter of representation and imagination', albeit these 'fictive heavens and fictive motions' could aspire to the status of 'correct representation'.²⁵

The issue of the ontological status of mathematical models became more acute when astronomers, such as Copernicus and Rheticus, began to assert their mathematical hypotheses not as *suppositiones* but as *certa demonstrationes*.²⁶ This increasing pressure from natural philosophy is mirrored in debates amongst mathematicians regarding the status of mathematics as a science, the ontological status of mathematical entities, and their applicability to the world of substances.

In her excellent monograph *Le matematiche e il mondo*, Anna De Pace outlines the influential debate between Italian peripatetics and Neoplatonists on these very issues, stimulated by the recovery and publication of Proclus' commentary on the first book of Euclid's *Elements*. Alessandro Piccolomini's *De certitudine mathematicarum*, which was annexed to his 1547 para-

²¹ See especially Pierre Duhem, *To save the phenomena: an essay on the idea of physical theory from Plato to Galileo*, trans. Edmund Doland and Chaninah Maschler (Chicago and London, 1969), pp. 36-60.

²² Giovanni Pontano, *De rebus cælestibus* (Basel, 1540), 'Proemium' to Book 3, p. 268. Duhem, *To save the phenomena*, p. 55.

²³ Ibid. p. 269; Duhem, *To save the phenomena*, p. 55.

²⁴ Ibid. p. 273; Duhem, *To save the phenomena*, p. 56.

²⁵ Lefevre d'Etaples, *Introductorium astronomicum, theorias corporum coelestium duobus libris complectens* (Paris, 1503); Duhem, *To save the phenomena*, pp. 56-7.

²⁶ See Duhem, *To save the phenomena*, pp. 61-91.

phrase of Aristotle's *Mechanical Questions*, for example, forcefully attacked the Averroist tradition which claimed that mathematical demonstrations possessed the highest degree of certainty of all scientific demonstrations, making use of that kind of demonstration which was called *potissimae*, which involved moving from evident propositions which are based on the inherent qualities of the object studied.²⁷ Mathematics was not concerned with efficient or final causes, Piccolomini argued: mathematical entities cannot be 'principles' or 'active potencies',²⁸ and Averroes was wrong to suggest that mathematics concerned itself with 'formal causes'.²⁹ Mathematical truths can be demonstrated in different forms, he argued, whereas the demonstrations called *potissimae* have a single, unique form related to the single unique cause of a phenomenon.³⁰ It was impossible, Piccolomini declared, to consider matter separate from form: '[there is] an almost essential relation between matter and its own form: for which reason one cannot be understood by the intellect without the other.'³¹ Mathematical entities, however, are abstractions from matter, and only exist in the imagination,³² thus mathematicians who sought to describe motion mathematically were dealing with metaphors and not the properties of motion itself.³³ Because they are abstracted from substance, mathematical entities are much simpler, and therefore it is easier to arrive at certain demonstrations of their properties.³⁴ Demonstrations of a natural (or metaphysical) type, on the other hand, deal with complex entities, which require assiduous observation, long experience and great labour in order to be understood.³⁵ Mathematics,

²⁷ Anna De Pace, *Le matematiche e il mondo: ricerche su un dibattito in Italia nella seconda metà del cinquecento* (Milan, 1998), pp. 22-3.

²⁸ Ibid., p. 24.

²⁹ Ibid., p. 25.

³⁰ Ibid., pp. 26-7.

³¹ Alessandro Piccolomini, *Filosofia naturale di M. Alessandro Piccolomini* (Venice, 1576), p. 24r: '[C']è quasi una relatione essenziale tra la propria materia, et la propria forma: per il qual rispetto non può l'una esser compresa senza l'altra dall'intelletto'; De Pace, *Le matematiche e il mondo*, p. 37.

³² De Pace, *Le matematiche e il mondo*, p. 39.

³³ Alessandro Piccolomini, *In Mechanicas Quæstiones Aristotelis, Paraphrasis paulo quidem plenior. Ad Nicolaum Ardinghbellum, Cardinalem Amplissimum. Eiusdem Commentarium de certitudine mathematicarum Disciplinarum: In quo de Resolutione, Diffinitione, et Demonstratione, necnon de materia, et in fine logicae facultatis, quamplura continentur ad rem ipsam, tum mathematicam, tum Logicam, maxime pertinentia*, (Venice, 1565), p. 100v: 'Mathematicus non consyderet motum, nisi metaphoricum. Demonstrare autem per metaphoras non debemus'; De Pace, *Le matematiche e il mondo*, p. 25.

³⁴ De Pace, *Le matematiche e il mondo*, pp. 44-5.

³⁵ Piccolomini, *De certitudine mathematicarum*, p. 106r: 'Cum igitur principia naturalia, resque ipsæ naturales, et etiam Metaphysicæ ex effectibus, longa experientia per sensum perceptis, cognoscantur, hoc autem longo tempore indiget, maximoque labore, et assidua observatione'; De Pace, *Le matematiche e il mondo*, pp. 44-5.

then, is concerned with knowledge of a restricted kind – it deals only with abstractions in the imagination, and is not equipped to deal with either material or formal causes.³⁶ It was deemed ‘incapable of expressing unequivocal and really necessary connections between the subject and its properties’.³⁷ Piccolomini even denied the truth-value of the findings of mixed mathematics, suggesting that the application of mathematics to natural bodies was essentially imperfect, and ignored the substantial essence of the objects which it studied.³⁸ Mixed mathematics may deal in certainties, he argued, but these certainties are non-scientific.³⁹ Real causes he argued, are arrived at by logical, not mathematical demonstrations.⁴⁰ Piccolomini saw mathematics as most useful for training the intellect in ‘divine science’ or theology, which also dealt with immaterial entities.⁴¹

As De Pace has shown, Piccolomini drew his ideas about mathematics as a ‘third being’ between matter and soul from Proclus, using the intermediary status of the mathematical entity as a way of excluding it from the domain of natural philosophy.⁴² However, it was also possible to argue the superiority of mathematics on the same basis: that its entities occupied an intermediary ontological status in the hierarchy of being. Francesco Barozzi, one of Piccolomini’s fiercest critics, maintained in his *Quæstio de certitudine mathematicarum*, published in 1560, that if mathematics occupied an intermediary position between natural philosophy and divine science, then its demonstrations must, of necessity, be of a higher order than those of natural philosophy.⁴³ Natural philosophy and mathematics did not deal with separate orders of reality: mathematics studied forms separated from matter, and natural philosophy studied enformed matter.⁴⁴ Nonetheless he persists in considering mathematical entities as immaterial, even though he argues that mathematical forms have their origin in sensible bodies.⁴⁵

These debates were followed by mathematicians in England,⁴⁶ and evidence of this complex set of tensions between a ‘pure’ Platonic mathemat-

³⁶ Ibid., pp. 47–51.

³⁷ Ibid., p. 53.

³⁸ Ibid., p. 54.

³⁹ Ibid., p. 57.

⁴⁰ Ibid., p. 54.

⁴¹ Piccolomini, *De certitudine mathematicarum*, pp. 96v–97r; De Pace, pp. 59–60.

⁴² De Pace, pp. 61–75. See esp. p. 62: ‘Piccolomini cerca di ricondurre questa interpretazione di Proclo sulla natura intermedia della matematica entro i propri schemi aristotelici.’

⁴³ Ibid., p. 128.

⁴⁴ Ibid., p. 137.

⁴⁵ Ibid., p. 137.

⁴⁶ Note especially the presence of Italian mathematical works in the libraries of mathematicians – John Dee owned copies of works by Alessandro Piccolomini (including the *Aristotelis Mechanicas Quæstiones* of 1547), Pietro Catena, Niccolò Tartaglia and Federico Commandino. Harriot’s papers show that he worked with a wide number of continental mathematical texts including works by Viète, Commandino, Stevin, etc.

ics which sought to maintain a view of mathematical entities as abstract, immaterial and distinct from substances, and a new awareness of the scope for practical and fruitful application of mathematics to arts and sciences can be found in the attitudes of the mathematical community in Gresham's London.⁴⁷ This can be clearly seen in the conflicting and contradictory objectives of Henry Billingsley's 1570 translation of Euclid's *Elements*, with its 'very fruitfull Præface' by John Dee.⁴⁸

Billingsley and Dee's collaboration is well known for its attempt to stimulate interest in applied mathematics. In two extensive addenda to Book 12 of Billingsley's translation, Dee sets out the avowedly practical agenda of his interventions. In the first of these, 'Iohn Dee his fruitfull instructions, with certain corollaries, and their great vse',⁴⁹ he declares his intention to 'furnish' the mathematical reader 'toward a more general art Mathematicall the[n] Euclides Eleme[n]ts', helping them to 'dilate ... [their] discourses mathematicall, or to invent and practise thinges Mechanically.'⁵⁰ Having presented his geometrical corollaries, Dee notes 'the great Mechanicall vse (besides Mathematicall considerations) which, these two corollaries may haue in Wheelles of Milles, Clockes, Cranes and other engines for water workes, and for warres, and many other purposes, the earnest and wittie Mechanicien will soone boulte out & gladly practise.'⁵¹ This practical orientation is underwritten by a pedagogical aid designed by Dee for the mathematical tyro to whom the book is notionally directed. This 'deuise, to helpe the imagination to young stude[n]ts in geometrie' involves a 'delineatio[n]

⁴⁷ These tensions were also evident in the mathematical lectures of Henry Savile, Dee's younger contemporary, delivered in 1570 (the same year as Billingsley's Euclid was published). See, for example, Savile's attack on the practical mathematical ethos of Ramus's *Prooemium mathematicum*: 'How I wish, Ramus, that you had followed Plato, Ptolemy, Proclus and other philosophers more learned than yourself and declared contemplation of the eternal realities to be the purpose of the most liberal of arts; instead you made the purpose of these arts mechanical and illiberal ... If only you had extolled the ascent to separated substances with your usual rhetorical gifts ... now instead we despise it, immersed as it is in such base things,' MS Savile 29, f. 5v, cit. Robert Goulding, 'Testimonia humanitatis: the early lectures of Henry Savile', in this volume, pp. 125–45.

⁴⁸ Henry Billingsley, *The Elements of Geometrie of the most auncient Philosopher Euclide of Megara. Faithfully (now first) translated into the Englishe tounge, by H. Billingsley, Citizen of London. Whereunto are annexed certaine Scholies, Annotations, and Inuentions, of the best Mathematiciens, both of time past, and in this our age. With a very fruitfull Præface made by M. I. Dee, specifying the chiefe Mathematicall Scie[n]ces, what they are, and wherunto commodious: where, also, are disclosed certaine new Secrets Mathematicall and Mechanicall, untill these our daies, greatly missed* (London: Iohn Daye, 1570). I would like to thank Robert Lenkiewicz of the Barbican, Plymouth, for allowing me to work on his copy of this book (and other works in his collection) in thoroughly congenial surroundings.

⁴⁹ Ibid., pp. 356r–357r.

⁵⁰ Ibid., pp. 371r–v.

⁵¹ Ibid., p. 357r.

in apt pastborde' together with a 'fine thred' to represent the third dimension of geometrical solids.⁵² This 'deuise' is incorporated in many of Billingsley's commentaries to Books 11-16, which are 'somewhat hard' for beginners who have to 'imagine lines and superficies to be eleuated and erected' when they are in fact 'described in a plaine'.⁵³ This visualization aid is said to help those 'Mechanically practising' as well as students.⁵⁴

In his second addendum, entitled 'Certaine theoremes and problemes (whose vse is manifold, in spheres, cones, cylinders, and other solides) added by Ioh[n] Dee'⁵⁵ purportedly written 'to informe the practiser mechanically',⁵⁶ Dee stresses the direct applicability of his geometrical considerations of geometrical solids both to celestial physics and to practical manipulation of sublunar solids:

the heauenly spheres, & sterres their sphericall soliditie, with their conuex spherical superficies, to the earth at all times respecting ... as also the whole earthly Sphere and globe it selfe, and infinite other cases, concerning Spheres or globes, may hereby with as much ease and certainty be determined of, as of the quantitie of any bowle, ball, or bullet, which we may gripe in our handes.⁵⁷

Billingsley's own comments and glosses annexed to his translation make constant reference to the applicability of geometry to natural phenomena. In praising the fifth book which deals with proportion and analogy as 'a chief treasure and a peculiar iuell much to be accompted of,' Billingsley notes its applicability to 'all other sciences also and artes: as *Musike*, *Astronomy*, *Perspective* ... the art of accomptes and reckoning.'⁵⁸ Analogy, he says,

pertayneth not onely vnto lines, figures and bodies in Geometry: but also vnto soundes & voyces, of which Musike entreateth ... [and] Also the whole arte of Astronomy teacheth to measure proportions of tymes and mouinges. Archimedes and Iordan with other, writing of waighes affirme that there is proportion betwene waight and waight, and also betwene place & place: Ye see therefore how large is the vse of the fife booke. Wherefore the definitions also thereof are common although here of Euclide they be accomodate and applied onely to Geometry.⁵⁹

⁵² Ibid., f. 380r.

⁵³ Ibid., p. 322r. For examples of the use of the pasteboard 'deuise' see, for example, pp. 325v, 327r.

⁵⁴ Ibid., p. 328v.

⁵⁵ Ibid., pp. 381v-381r.

⁵⁶ Ibid., p. 386v.

⁵⁷ Ibid., 389v.

⁵⁸ Ibid., p. 125v.

⁵⁹ Ibid.

In the argument of Book 7, Billingsley likewise argues that mathematics – and especially arithmetic – is vital in the study of natural philosophy:

Arithmeticke, not onely aydeth Geometrie: but ministereth principles, and groundes to many other, nay rather to all other sciences and artes. As to musicke, Astronomy, naturall Philosophy, perspective, with others ... In Astronomie, who without the knowledge of number can doe any thing, either in searching out of the motions of the heauens and their courses, either in iudging or foreshewing the effects of them? In natural philosophie, it is of no small force.⁶⁰

Despite the ostensibly practical and mechanical orientation of this work, the view of mathematics which it promotes – like that of Piccolomini – still emphasizes the ontological separation between abstract mathematical entities and the world of real substances. Thus the ‘force’ which Billingsley attributes to arithmetic is seen as a direct consequence of number’s immaterial and abstract nature.

[N]umber ... falleth vnder no sence, nor is represented by any shape, forme or figure: and therefore cannot be iudged by any sense, but only by the consideration of the minde, and vnderstanding. Now thinges sensible are farre vnder in degree then are thinges intellectuall: and are of nature much more grosse then they. Wherefore number ... is more pure, more immateriall and more subtile, farre then is magnitude: and exte[n]deth it selfe further.⁶¹

Theoretically the applicability of mathematical entities is grounded in their ideality – Billingsley refers us to the ‘wisest and best learned philosophers ... *Pithagoras, Timeus, Plato*, and their followers’ who presented number as a ‘secret and hidden knowledge of the nature and condicion of all thinges’. Number is the ‘constitucion’ of natural things; the soul is ‘composed of harmonically numbers’, it is ‘the being and very essence of all thinges.’ This metaphysical horizon of the mathematical entity, however, is presented alongside an untheorized practical or technical horizon. Thus in this same passage Billingsley refers to the testimony of him who ‘hath ... traueled’ in perspective or other sciences which are ‘practised in common life,’ without articulating how these practical applications relate to the mathematical entity as ideal essence.

In his *Præface* Dee also insists on the immateriality and abstract nature of mathematical entities. He adopts the Boethian-Platonic distinction between abstract number – the province of the true mathematician – and real number, which was the province of ‘vulgar Practisers’ such as ‘the common Logist, Reckenmaster, or Arithmeticien’. ‘In Numbryng’, Dee noted, ‘we say one, two, three. But how farre, these visible Ones, do differre from our Indiuisable

⁶⁰ Ibid., p. 183r.

⁶¹ Ibid.

Vnits (in pure *Arithmetike* principally considered) no man is ignorant.⁶² He also notes the ontological distinction between mathematical and physical entities, insisted upon by both Plato and Aristotle. Thus 'thinges naturall' are 'materiall, compounded, diuisible, corruptible and chaungeable', whereas 'Thynges Mathematicall' possess 'generall Formes' which are 'constant, vnchaungeable, vntransformable, and incorruptible', albeit their sensible or mental 'Images' are 'by Art ... aggregable and diuisible'. Mathematical entities constitute a 'third being' midway between perfect, unchanging supernatural things (which are 'simple [and] indivisible') and the complex divisibility of the material world.⁶³ Pure number is 'Immaterial and free from all matter', purer than the elements, 'Aristoteles *Quinta Essentia*' and even 'substance Spirituall or Angelicall',⁶⁴ the Mercuriall fruite of Dianoeticall discourse, in perfect imagination subsysting'. Nonetheless its 'mervaylous newtralitie' represents a 'straunge participation' between 'thinges supernaturall ... and thynges naturall'.⁶⁵ Mathematics aids the pursuit of sciences, Dee believed, because it was used by God in

the distinct creation of all creatures: in all their distinct partes, properties, natures and vertues, by order, and most absolute number, brought from Nothing, to the Formalitie of their being and state.⁶⁶

As a mathematical entity, Dee's 'absolute number' is a hypostatic formal principle of creation. As such the mathematician's relation to it is both theological and gnostic - to encounter 'absolute' number is immediately to experience a revelation, unveiling or beholding:

By Numbers propertie ... we may both winde and draw our selues into the inward and deepe search and vew, of all creatures distinct vertues, natures, properties, and Formes: And also, farder, arise, clime, ascend and mount vp (with speculatiue Winges) in spirit, to behold in the Glas of Creation, the Forme of Formes, the Exemplar Number of all thinges Numerable: both visible and inuisible: mortall and immortall.⁶⁷

This metaphysical attitude toward mathematical forms is evident also in Dee's views on geometry. While he concedes that geometry can have applications to physical reality (in land-surveying, for example), he saw geometry's primary function as being a heuristic form of gnostic meditation. In

⁶² *The Elements of Geometrie ... by H. Billingsley*, sig. *jv-ijr.

⁶³ *Ibid.*, sig. iijv: 'For, these, beyng (in a maner) middle, betwene thinges supernaturall and naturall: are not so absolute and excellent, as thinges supernaturall: Nor yet so base and grosse, as things naturall: and neuerthelesse, by materiall things hable somewhat to be signified.'

⁶⁴ *Ibid.*, sig. *jr.

⁶⁵ *Ibid.*, sig. iijv.

⁶⁶ *Ibid.*, sig. *jr.

⁶⁷ *Ibid.*

order to keep these functions separate, in fact, he named the superior form of geometry '*Megethica* or *Megethologia*',⁶⁸ reserving the term 'geometry' ('a name to base and scant for a Science of such dignitie') only for its practical (and etymological) meaning of 'land-measuring'. 'Megethologicall Contemplations', he said, were to

trayne our Imaginations and Myndes, by litle and litle to forsake and abandon, the grosse and corruptible Obiectes of our outward senses: and to apprehend ... Things Mathematicall. And by them, readily to be holpen and conducted to conceiue, discourse and conclude of things Intellectual, spiritual, aeternall, and such as concerne our Blisse euerlasting.⁶⁹

It is clear that in his magical works Dee is operating with a conception of mathematics which was essentially different from modern mathematics (or even those of the late seventeenth century). Like Cornelius Agrippa who in his *De occulta philosophia* suggested that through 'abstract, mathematical and celestial things we receive celestial virtues, namely motion, life, sense, speech, foreknowledge and divination',⁷⁰ Dee's *Monas Hieroglyphica* – which deals with the mystical properties of a geometrically constructed 'hieroglyph', the 'monas' (Fig. 2a & b) – has a peculiar conception of the mathematical entity and the natural philosopher's relation to it. The mathematical object of 'divine mathesis', as he calls it,⁷¹ has a symbolic, hypostatic function, and the mathematician-adept relates to it as a 'hermeneut' and a meditator. He refers to the *Monas* as an 'interpretation of mysteries',⁷² and he refers to the theorems and demonstrations of the work as 'hieroglyphical syllogisms', assuming a cabalistic osmosis between geometrical and literal figures.⁷³ The lines which make up Dee's symbol are geometrically constructed,⁷⁴ but the ontological status of these lines is profoundly different from a mere idealized representation of space. The 'geometrical

⁶⁸ Ibid., sig. a.ijr-v.

⁶⁹ Ibid., sig. a.iiir.

⁷⁰ Cornelius Agrippa, *De occulta philosophia*, Book II, Cap. 1, *Opera*, I, p. 154. On Agrippa's mathematical magic see A.G. Molland, 'Cornelius Agrippa's mathematical magic' in *Mathematics from manuscript to print, 1300–1600* (Oxford, 1988), pp. 209–19.

⁷¹ John Dee, *Monas Hieroglyphica*, *Ioannis Dee, Londinensis, Ad Maximilianum, Dei gratia Romanorum, Bohemiae et Hungariae regem sapientissimum* (Antwerp, 1564), trans. C.H. Josten, 'A translation of John Dee's *Monas Hieroglyphica* (Antwerp, 1564) with an introduction and annotations', *Ambix*, 12 (1964), pp. 84–221, on p. 181.

⁷² *Monas Hieroglyphica*, trans. Josten, p. 185.

⁷³ See *Monas Hieroglyphica*, trans. Josten, pp. 125–9. On Dee's cabalistic interpretation of geometry see Nicholas H. Clulee, *John Dee's Natural Philosophy, between science and religion* (London and New York, 1988), pp. 77–115.

⁷⁴ See *Monas Hieroglyphica*, trans. Josten, esp. pp. 201–2 where he gives a step-by-step geometrical construction, followed by a description of its construction 'as the mechanics speak' to facilitate its construction by 'those wishing to bear it on rings and seals, or to use it in other ways.'

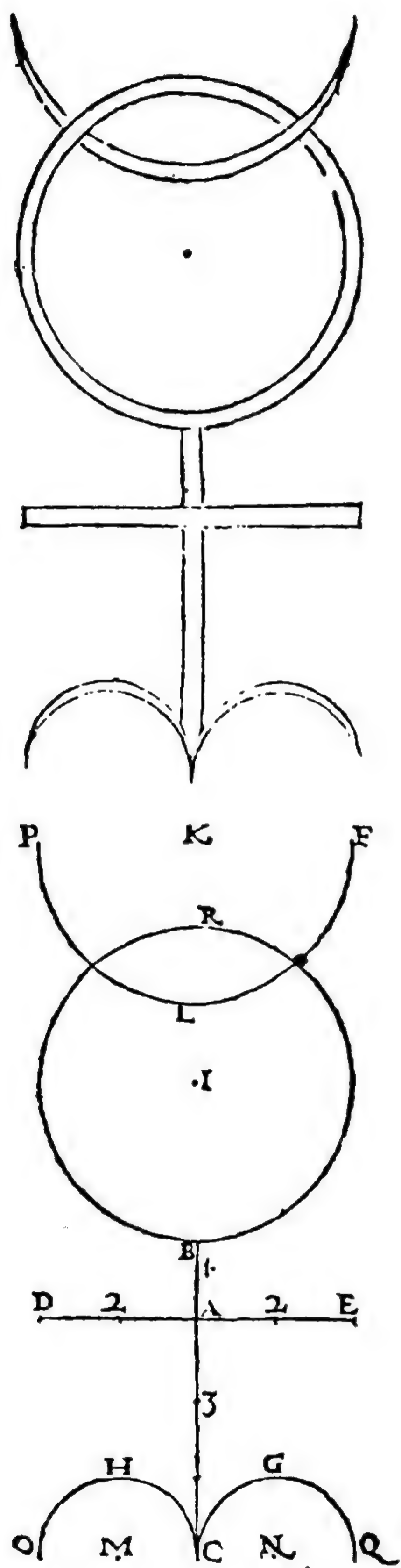


Fig. 2 (a) John Dee's 'hieroglyphic monad', and (b) its geometrical construction, from his *Monas Hieroglyphica* (Antwerp, 1564), pp. 24-5.

members' of the monas, Dee says, 'are filled with mutual sympathy, allowing ... a most absolute monadic unity. In this way a magnetic virtue is active in those members.'⁷⁵ The 'binary lines' which make up the cross-section of the figure are said to possess a 'hypostatic property'⁷⁶ and are seen as direct significations of cosmic structural properties. The 'mystery of the four elements', for example, 'is intimated by the four straight lines going forth from one indivisible point,'⁷⁷ while the symbol of Aries - 'two half-circles joined together in one point' - are said to 'denote [the earth's] most secret proportions.'⁷⁸ The sign in its totality is seen as signifying the structure of the solar system:

Raising towards heaven our cabbalistic eyes (that have been illuminated by speculation on these mysteries) we shall behold an anatomy precisely corresponding to our monad ... which will quite openly discover the most secret mysteries of this analysis of the physical world.⁷⁹

The mathematician's use of this mathematical 'key' (as Yates would call it) is twofold. First he relates to it as hermeneut - Dee is the expounder of the geometrical letter - the mysteries of the figure require 'interpretation,'⁸⁰ and are 'released only by the uncommon activity of a master'.⁸¹ Secondly he relates to it as a mystic or meditator. When using the figure in the process of alchemy, for example, the 'spirit' of the planet Mercury is said to 'work' through the diagram when he 'speaks with words, hieroglyphically, when we are alone with him for about the length of an average day.'⁸² The mathematical 'schemes' of the monas have to be 'considered in an inward manner': its mysteries require that we 'fix our eyes on him and lend him a more attentive ear.'⁸³ When this is done, the celestial influences 'work' through the geometrical lines, which are considered as 'living' in some way, 'introducing and impressing' themselves onto the matter which is being worked with.⁸⁴ They are 'characters imbued with immortal life' rather than 'dumb ... or quasi-barbaric signs'.⁸⁵

⁷⁵ Ibid., p. 193.

⁷⁶ Ibid., p. 183.

⁷⁷ Ibid., p. 159.

⁷⁸ Ibid., p. 161.

⁷⁹ Ibid., pp. 175-7.

⁸⁰ Ibid., p. 185.

⁸¹ Ibid., p. 187.

⁸² Ibid., p. 163 (I have slightly altered Josten's translation here).

⁸³ Ibid., p. 165.

⁸⁴ Ibid., p. 163.

⁸⁵ Ibid., p. 121: 'My gift is endowed with rareness also in so far as from first to last it is woven together by a manner of writing in which up to the present day ... no work has ever been composed. Though I call it a hieroglyphic, he who has examined its inner structure will grant that all the same there is in it an underlying clarity and strength almost mathematical,

Dee's mathematical entity then is more than a representation or an analogy in the modern sense, it is a living 'junction box' which can channel spiritual energies into the physical world through the medium of a meditating subject. In this epistemological context the mathematical entity is a talismanic or symbolic operator in which there is an assumed analogical identity between diagram and the structural principles of physical nature, and a pneumatic transfer of spiritual power or virtue innate in the representation. The 'application' of the talismanic mathematical entity assumes an act of meditation, and an occult transference of power (an 'impression').⁸⁶

While in its treatment of 'Thaumaturgike' and 'Archemastrie',⁸⁷ and in its privileging of the mathematical entity as immaterial abstraction, his *Præface* underwrites this magical application of mathematics, Dee is also mindful of his brief to 'satisfie the workemans request' and deal with 'the frute and commodity'⁸⁸ of mathematics. He therefore deals with mathematical applications of a very different kind, importing new epistemological assumptions as he does so. Thus when he discusses the geometrical sciences of 'Geographie', 'Chorographie', 'Hydrographie' and 'Stratarithmetrie'⁸⁹ Dee defines an 'analogicall' relationship between mathematical figures and their objects which is unrelated to the concept of analogia as it is understood in the occult sciences.⁹⁰ Hydrography, for example, is described as 'the perfect Analogicall description of the Ocean sea coastes'; Chorography, he says, 'teacheth Analogicallly to describe a small portion or circuite of groundes' in the form of a diagram. This analogical description is a very different kind of application from that assumed in his 'quasi-mathematical' (*quasi mathematicum*)⁹¹ oc-

such as is rarely applied in writings on matters so rare. Or is it not rare, I ask, that the common astronomical symbols of the planets (instead of being dumb), or ... quasi-barbaric signs should have become characters imbued with immortal life and should now be able to express their especial meanings most eloquently in any tongue and any nation?'

⁸⁶ On the 'ontological status and cosmological role' of mathematical entities in Neoplatonic or Pythagorean mathematics see Strong, *Metaphysics and procedures*, p. 12: 'Unity, point, number, and geometrical forms are hypostasized or reified as subsistent, cosmological entities ... The relation of cosmological number and form to existence is that of exemplar or class to examples or members.'

⁸⁷ *The Elements of Geometrie ... by H. Billingsley*, sig. a.jr-aiijr. On Dee's 'Archemastrie' see Clulee, *John Dee's Natural Philosophy*, pp. 170-76.

⁸⁸ *The Elements of Geometrie ... by H. Billingsley* sig. a.iiijv.

⁸⁹ *The Elements of Geometrie ... by H. Billingsley* sigs. a.iiijr-v.

⁹⁰ On the role of analogy in the occult sciences see Brian Vickers, 'On the function of analogy in the occult', in Ingrid Merkel and Allen. G. Debus (eds), *Hermeticism and the Renaissance: intellectual history and the occult in early Modern Europe* (Washington, 1988), pp. 265-92 and 'Analogy versus identity: the rejection of occult symbolism, 1580-1680', in Brian Vickers (ed.), *Occult and scientific mentalities in the Renaissance* (Cambridge, 1984), pp. 95-163.

⁹¹ Dee uses this adjective to describe his geometrically-constructed hieroglyph, see *Monas Hieroglyphica*, trans. Josten, p. 121.

cult sciences: it assumes a direct mapping of the real into geometry, which become 'figure[s] exactly proportional to the figure assigned', which are 'described and designed, in com[m]ensurations Analogicall to Nature and veritie.' Whereas in the *Monas* measurement and proportion are seen as mystically imperative,⁹² here commensuration involves observing a homological spatial relationship between diagram and idealized space.

In his 'Annotation staticall', in which he describes a series of mechanical verifications and applications of the proportions of spheres, cylinders and cube (as they are set out in his addenda at the end of Billingsley's Book 12), Dee also envisages a different mode of mathematical application, here presented as 'the knowledge sensible, and Experimentall of *Archimedes* great Secret.'⁹³ Beginning with six axioms 'out of Archimedes demonstrations,'⁹⁴ Dee goes on to outline a series of 'Experimentall demo[n]stration[s]' involving the fashioning of geometrical solids out of 'Copper, Tinne, Lead, Siluer &c',⁹⁵ weighing them to find the proportions between their weights.⁹⁶ Dee apologizes for being 'Mathematically and Mechanically ... very long in wordes'⁹⁷ in this experimental narrative, and it is precisely the translation of mathematical entities into practical procedures which is most significant here. By importing an Archimedean mathematization of phenomena into his work Dee moves toward a resolution of the natural and the mathematical which peripatetic physics had disallowed. 'And though it be Naturally done and Mechanically', says Dee, 'yet it hath a good Demonstration Mathematicall.'⁹⁸

According to Husserl, the new physics was achieved 'through growing approximations in the sphere of shapes' which rendered them 'more and more perfect indices of the qualitative plena'⁹⁹ - that is, concrete bodies became mathematically 'determinable through [mathematical] approximations'.¹⁰⁰ We can certainly see this process at work in Dee's Archimedean experiments. While Dee holds theoretically to geometry as immaterial ideality,

⁹² *Monas Hieroglyphica*, trans. Josten, p. 207: '[N]o harm, (not even the slightest) [must be] done to our mystical proportions, lest by some negligence the new discipline of those true (and most necessary) hieroglyphic measurements may, in the course of time ... be thrown into confusion and perish.'

⁹³ *The Elements of Geometrie ... by H. Billingsley*, sig. c.iv.

⁹⁴ *Ibid.*, sig. b.iiijv-c.jr.

⁹⁵ *Ibid.*, sig. c.jv.

⁹⁶ *Ibid.*, sig. c.jv. He also calculates the proportion between a square and the circle inscribed within it, by inscribing them on 'Gold, or Latton Lamyns or plates' and then cutting off or filing away the plate around the circle and comparing the difference in their weights (sig. cij.r).

⁹⁷ *Ibid.*, sig. c.iiijv.

⁹⁸ *Ibid.*, sig. c.iiijr.

⁹⁹ Husserl, *Crisis*, p. 40.

¹⁰⁰ *Ibid.*

here he adopts a pragmatic approximative viewpoint. Thus he says that the experimenters' solids should be 'perfectly fashioned' and 'great diligence [must] be vsed, to approache (as nere as may be) to the Mathematicall perfection of those figures.'¹⁰¹ In order to make experiments 'depend' upon mathematical demonstration, the physical world must be 'idealized' (or 'coidealized' as Husserl says) in order to make it commensurate with the mathematical entities. This process was aided, as Husserl notes, by the idealization of measurement. Thus, while physics was struggling to co-opt mathematical demonstration 'the art of measuring [was] ... at the same time ... pushing the exactness of measuring further and further in the direction of growing perfection.'¹⁰² This is particularly noticeable in Dee's strategy for geometrically accommodating nature's geometrical imperfections. When measuring volumes contained in hollow cones and cylinders he notes that the 'Superficies of the water' is not level, but 'Sphericall'. Therefore, he says, the experimenter must 'vse ... discretion' in filling the containers, allowing 'a small haire breadth more' to account for this sphericity. This rough approximation, however, is supplanted by a more exact calculation 'For finding the swelling of the water aboue the leuell' which involves subtracting the squares of the semidiameter and the subtendent of the spherical meniscus.¹⁰³ For larger-scale calculations of this kind, where the difference will not be 'insensible', he recommends the 'helpe of my sixt Theoreme vpon the last Proposition of Euclides twelfth booke.'¹⁰⁴ This exactitude of allowances is a vital part of approximation, and necessary if mathematical truths of nature are to be experimentally verifiable and practically applicable. By these statical rules, Dee says 'may any regular body, be Transformed into an other', and thus

may you, of any mould, or Modell of a Ship, make one of the same Mould (in any assigned proportion) bigger or lesser ... [or] of any Gunne ... make an other, with the same Symmetrie (in all points) as great, and as little as you will.¹⁰⁵

Whereas the application and operation of mathematics in magic involves more than one level of the hierarchy of being, and thus an analogy of material to immaterial hingeing on the *medietas* of the mathematical entity, here the analogy is ontologically confined to bodies, and involves the approximate co-identity of the mathematical entity with the object (copper cone, ship or gun).

¹⁰¹ *The Elements of Geometrie ... by H. Billingsley*, sig. c.ijr.

¹⁰² Husserl, *Crisis*, pp. 40–41.

¹⁰³ *The Elements of Geometrie ... by H. Billingsley*, sig. c.ijr.

¹⁰⁴ *Ibid.*

¹⁰⁵ *Ibid.*, sig. c.ijv.

In his *Præface* to Billingsley's Euclid, Dee stressed the mathematician as able to move freely up and down the hierarchy of being, between the practical and speculative spheres of his discipline.

Thus, can the Mathematicall Minde, deal Speculatiuely in his own Arte: and by good meanes, Mount aboue the cloudes and sterres: And ... he can [also] by order, Descend, to frame Naturall thinges, to wonderfull vses.¹⁰⁶

What is not explicitly theorized, however, is that this movement is a movement between different modes of mathematical entity and between different epistemologies.¹⁰⁷ In her gloss on the birth of mathematical physics out of mathematical magic, Yates seems to assume that their underlying concepts of mathematical application and operation are commensurate. However, it is clear from even a cursory examination of the *Præface* and the *Monas* that Dee envisages very different forms of operation and application for 'divine mathesis' on the one hand and 'Artes Mathematicall Deriuatiue' on the other. Dee firmly subordinates practical mathematics, granting its existence only with 'the allowance of the Metaphisicall Philosopher', and thus qualifying its ability to apply the 'Mathematicall demonstratiue method' which is compromised by the infirmity of its subject matter. These 'Methodicall Artes' use mathematical principles, but are seen as 'declýning from the purity, simplicitie, and Immateriality' of true geometry in order to deal with the imperfect forms of substances. Thus according to Dee the practitioner 'ordreth and confirmeth his doctrine, *as much & as perfectly, as the subiect matter will admit*.'¹⁰⁸

The untheorized difference underlying (and fissuring) Dee's *Præface* is that between a mystical epistemology and a real-modelling epistemology. This does not assume a symbolic or talismanic analogy between immaterial mathematical entity and the underlying substrate of physical reality, but a direct homology or immediate analogy between mathematical entity and physical reality which 'operates' at the level of analogical description rather than pneumatic intervention.

This difference is evident if we compare Dee's mathematical practice with that of his friend¹⁰⁹ and younger contemporary Thomas Harriot. Harriot believed very strongly in the analogical descriptive powers of mathematical

¹⁰⁶ Ibid., sig. c.iiijr.

¹⁰⁷ In this respect I find Enrico Rambaldi's treatment of Dee's *Præface* ('John Dee and Federico Commandino: an English and an Italian interpretation of Euclid during the Renaissance', in Lino Conti [ed.], *La matematizzazione dell'universo: momenti della cultura matematica tra '500 e '600*, [Assisi, 1992], pp. 49-86) rather unsatisfactory. Professor Rambaldi's admirable discussion reflects but does not reflect *upon* the internal contradictions of Dee's objectives.

¹⁰⁸ *The Elements of Geometrie ... by H. Billingsley*, sig. a.iiijr [my emphasis].

¹⁰⁹ See Feingold, *Mathematicians' apprenticeship*, pp. 136-7 and Clulee, *John Dee's natural philosophy*, p. 229.

forms: 'the rates of ... waights, forces, times, [and] velocities', he said, 'may be expressed by lines.'¹¹⁰ If we look at Harriot's treatment of kinetic and ballistic problems in the 1590s, we find an application of this belief in the mathematical entity as a real model for physical process. In his *Præface*, Dee gave qualified praise to Niccolò Tartaglia's advances in this doctrine. In its 'entending purpose', he says, 'allowing somewhat to the imperfection of Nature: [it is] not aunswerable to the precisenes of demonstration.'¹¹¹ Harriot, however, presses further in his treatment of ballistics, attempting to mathematize nature's 'imperfections'. He begins with the idea that a moving object possesses an initial velocity equal to that of the moving force:

Anie thing being in quiet when it begins to move because it is moved by a cause; that beginning is not no[n] gradu; but the vis be it materiall or immateriall must be of some degree & the mobile must begin ... with the same degree which may be of diuers quantities; in this diagram I name it ab & that degree is aequall to some degree of the increase as cd.¹¹²

It is interesting to note that Harriot's consideration of moving bodies is irrespective of cause – it is sufficient for him to consider that there *is* 'a cause' – and for his purposes it matters little whether the motive force is 'materiall or immateriall' and is assumed as a datum. The important thing for Harriot is that the impetus having been impressed is of a determinate quantity ('of some degree') which is assumed as the initial velocity of the 'mobile', and by being deemed equivalent to 'some degree of the increase [of velocity]' becomes the first step in a continuous proportional progression which can be represented geometrically. Here, as elsewhere in his papers,¹¹³ Harriot makes use of the medieval 'configuration doctrine' which Nicolaus Oresme and philosophers of the Merton school developed in discussions of the intension of motions and qualities, including Bradwardine's law and Heytesbury's 'mean degree theorem'.¹¹⁴ This doctrine, which repre-

¹¹⁰ British Library, Harleian MS 6002 (Charles Cavendish's transcriptions of MSS by Thomas Harriot), f. 27v.

¹¹¹ *The Elements of Geometrie ... by H. Billingsley*, sig. c. jr.

¹¹² Harleian MS 6002, f. 25r.

¹¹³ See Stephen Clucas, *Thomas Harriot and the field of knowledge in the English Renaissance*, Oriel College Oxford, the 1994 Thomas Harriot Lecture (Oxford, 1995), pp. 23–6.

¹¹⁴ For the clearest accounts of this doctrine see Clagett, 'Some novel trends', in Singleton (ed.), *Art, science and history in the Renaissance*, pp. 275–303; John E. Murdoch and Edith D. Sylla, 'The science of motion', in David C. Lindberg (ed.), *Science in the Middle Ages* (Chicago and London, 1978), pp. 206–64. On Bradwardine's law see George Molland, 'The geometrical background of the "Merton School", an exploration into the application of mathematics to natural philosophy in the fourteenth century', *Brittish Journal for the History of Science* 4 (1968), pp. 108–25, on pp. 119–120, and Annalise Maier, *Die Vorläufer Galileis im 14 Jahrhundert* (Rome, 1949), pp. 86–95.

sented the increase in qualities or motions by means of geometrical surfaces, was used by Galileo in his proof of the fundamental uniform acceleration theorem,¹¹⁵ and was freely available in printed form during the sixteenth century.¹¹⁶ Just as Galileo took aspects of the medieval science of motion and transformed them,¹¹⁷ Harriot also approached his medieval antecedents in a new spirit. While the medieval *calculatores* devised elaborate logico-mathematical problems on moving bodies, their intention was to devise 'sophisms' to exercise student ingenuity rather than to make truth claims about the mathematical nature of physical reality. For these philosophers 'everything was formulated and analyzed *secundum imaginationem*, not *secundum cursum naturae* (following one's creative imagination and not what occurs according to the order of nature).'¹¹⁸ In Harriot's case, I would argue, there is an assumption that geometrical models are true and accurate representations of physical phenomena.

Like his medieval antecedents, Harriot represents uniform accelerated motion as a right-angled triangle,¹¹⁹ although, unlike them, he assumes an initial velocity rather than beginning at rest. '[I]n this diagram' (Fig. 3), Harriot says, 'I name it [i.e. the initial velocity] ab'. This act of designation assumes a direct homology between the velocity of a physical object and its geometrical representation. This simple representation of motion is sophisticated in the next diagram (Fig. 4) by diagrammatically indicating the various stages of the body's ascent and descent, as well as the impediments to its forward motion. Thus ABC is designated 'the triangle of ascent in vacuo' (that is, unimpeded by friction), while AFB and FGB are the triangles of ascent and descent respectively 'in the medium of air' (*in medio aereo*). The 'triangle of the ayres resistance to be abated' is designated by either ADE or AEF, while the actual 'resistance of the ayre [to the body] in descent' is represented by AFG. Taking AB as the line of velocity in a vacuum in the triangle ABC, the actual velocity is calculated by subtracting the triangle of resistance, which leaves 'the velocity GB'. As Dee handled the 'imperfection' of the meniscus through solid geometry, so Harriot represents air resistance as a geometrical constant.

Having represented the continual increase of velocity of a moving body as a triangle, Harriot develops his argument *more geometrico*. Thus in the following diagram (Fig. 5) Harriot establishes the final velocity if the in-

¹¹⁵ Marshall Clagett, 'The pre-Galilean configuration doctrine: "The Good Treatise on Uniform and Difform [Surfaces]"', in Carlo Maccagni (ed.), *Saggi su Galileo Galilei* (Florence, 1967), pp. 1-24 (1-2).

¹¹⁶ M. Clagett, *The science of mechanics in the Middle Ages* (Madison, Wisconsin, 1959), p. 414.

¹¹⁷ Murdoch and Sylla, 'The science of motion', p. 249.

¹¹⁸ Ibid., p. 247.

¹¹⁹ Clagett, 'Pre-Galilean configuration doctrine', p. 2.

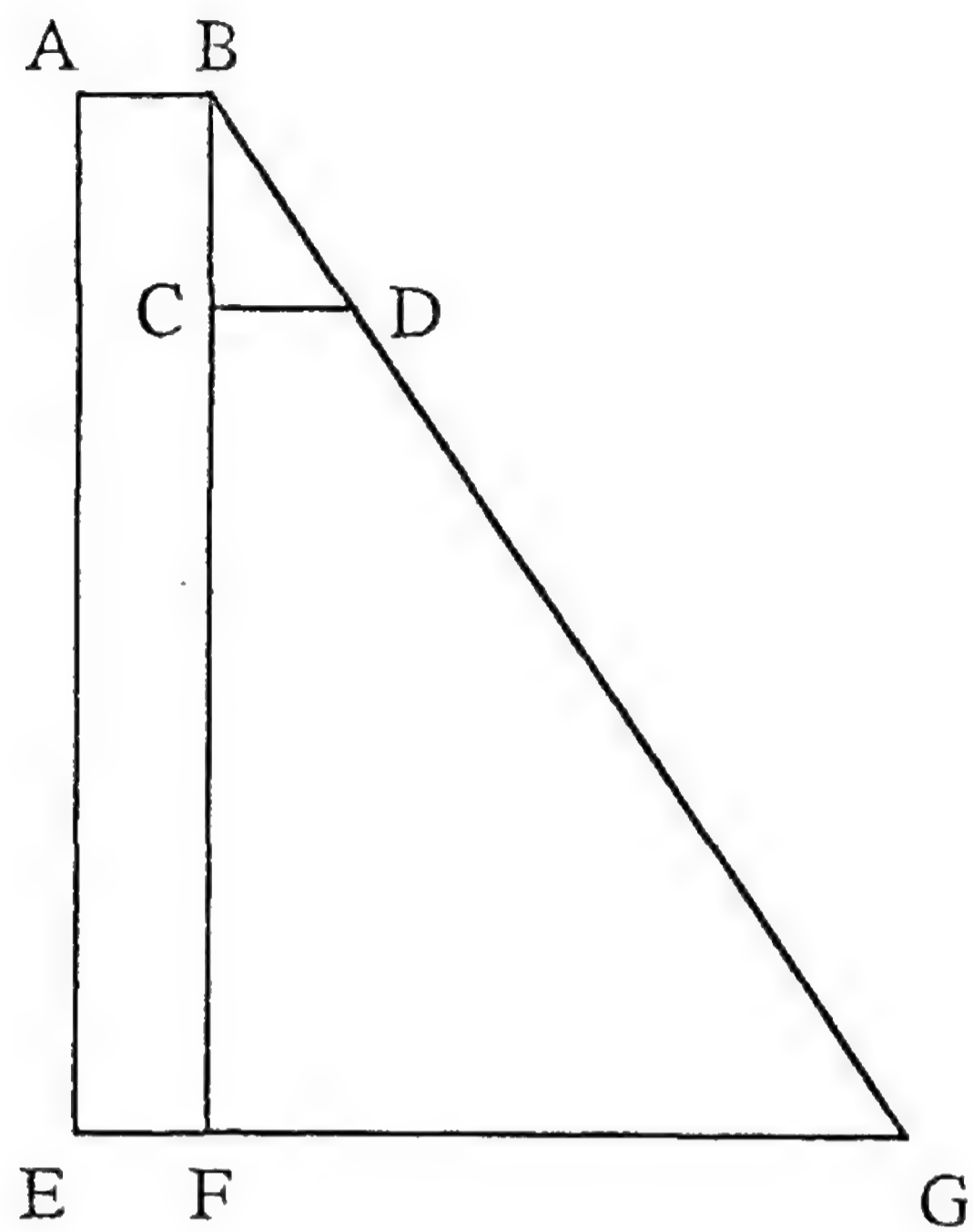


Fig. 3 Diagrammatic representation of uniform difform motion of a body with initial velocity AB , after Thomas Harriot, Mathematical Papers, British Library Add. MS 6789, f. 30v.

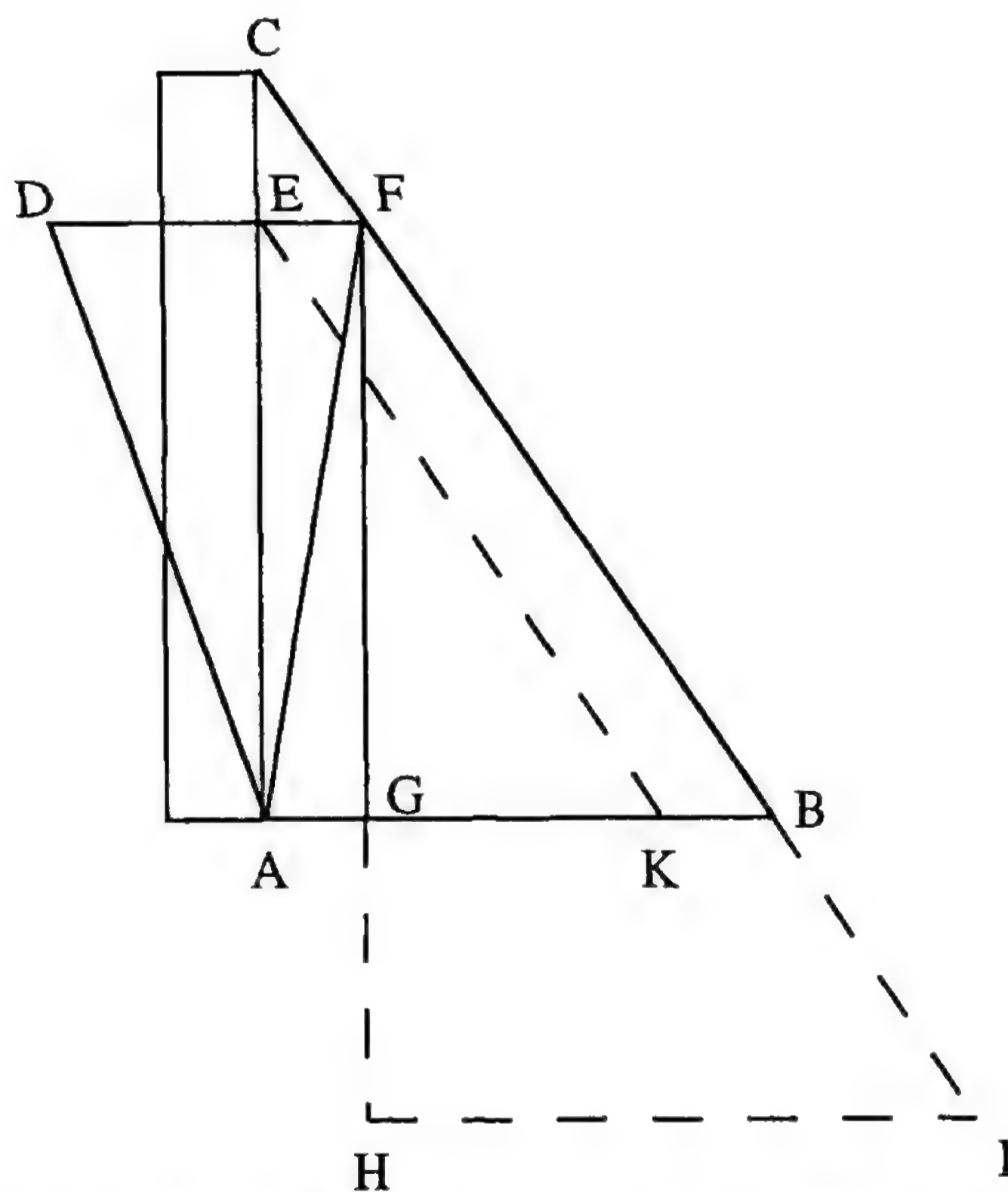


Fig. 4 Diagrammatic representation of uniform difform motion of a body encountering uniform air resistance AFG , after Thomas Harriot, Mathematical Papers, British Library Add. MS 6789, f. 30v.

crease is uniform rather than difform over the same space.¹²⁰ Here the line AF indicates the space moved, and the line BH the increasing degrees of motion. Thus in the space AC the degree of motion is CE, and in the space AF the degree of motion is FH:

devide fh in two æquall partes in the poynt i & make vp the parallelogram[m]e akif, the[n] ak shold be the degree in respecte of the first degree ab, to moue the space af in the same time as it did before difformiter.¹²¹

In order to 'deuide the space moued diformiter by æquall time, or accordinge to any other proportion of times,' Harriot suggests that the 'trapeze or quadrangle bafh [be divided] ... according to that proportion, by the doctrine of Bagdedinus, Comandinus, or Stevinus.'¹²² This refers in part to the geometrical work *De superficierum divisionibus* attributed to Muhammad Al-Baghdadi (or Bagedinus), published in 1570 by Federico Commandino at the request of John Dee.¹²³ The eighth proposition of this work includes Bagedinus' method (Fig. 6) for dividing 'a known quadrangle ABCD, having two parallel sides ... according to a proportion given.'¹²⁴ Commandino appends his own method for dividing geometrical surfaces to the translation of Bagedinus, including a method for dividing a quadrangle according to a given proportion from any side or angle.¹²⁵ Simon Stevin, in his *Problematum Geometricorum*, devised two alternative methods for solving the same problem.¹²⁶ The methods of Stevin, Commandino and Bagedinus all involve constructions and demonstrations from the familiar properties of

¹²⁰ It was customary in the configuration doctrine to represent uniform motion by a rectangle and uniform acceleration by a triangle. Claggett, 'Pre-Galilean configuration doctrine', p. 2.

¹²¹ British Library, Add. MS 6789 (Thomas Harriot, Mathematical Papers), f. 30r.

¹²² Add. MS 6789, f. 30r.

¹²³ Federico Commandino, *De superficierum divisionibus Liber Machometo bagedino ascriptus Nunc primum Ioannis Dee Londintensis & Federici Commandini Vrbinatis opera in lucem editus. Federici Commandini de eadem re Libellus* (Pisauri: Hieronymum Concordiam, 1570). Dee is unclear as to the identity of this author, speculating that it may have been the Arab writer Albategnius often cited by Copernicus, or a disciple of Al-Kindi (sig. +3v). On the basis of a passage in Proclus he believed it to be a lost work of Euclid which had taken the name of its Arabic translator. In his address 'Lectori', he simply states: 'auctorem hunc, que tibi exhibemus, Euclide vsum in arabicam linguam conuerso, quem postea Campanus latinum fecit.' (sig. +4v).

¹²⁴ Ibid., pp. 11-15: 'Quadrangulum notum duorum æqui distantium laterum per lineam ... secundum proportionum datam dividere'.

¹²⁵ Ibid., pp. 56-9.

¹²⁶ Simon Stevin, *Problematum Geometricorum in gratiam D. Maximilian, Domini A. Cruningen &c. editorum*, Libri V (Antwerp: Ioannem Bellerum ad insigne Aquilæ aureæ, 1583), Problema VII: 'In dato trapezio rectam lineam ducere parallelam cum latere trapezium quæsito quæ trapezium diuidat versus partem quæsitam secundum rationem datam.', pp. 30-5.

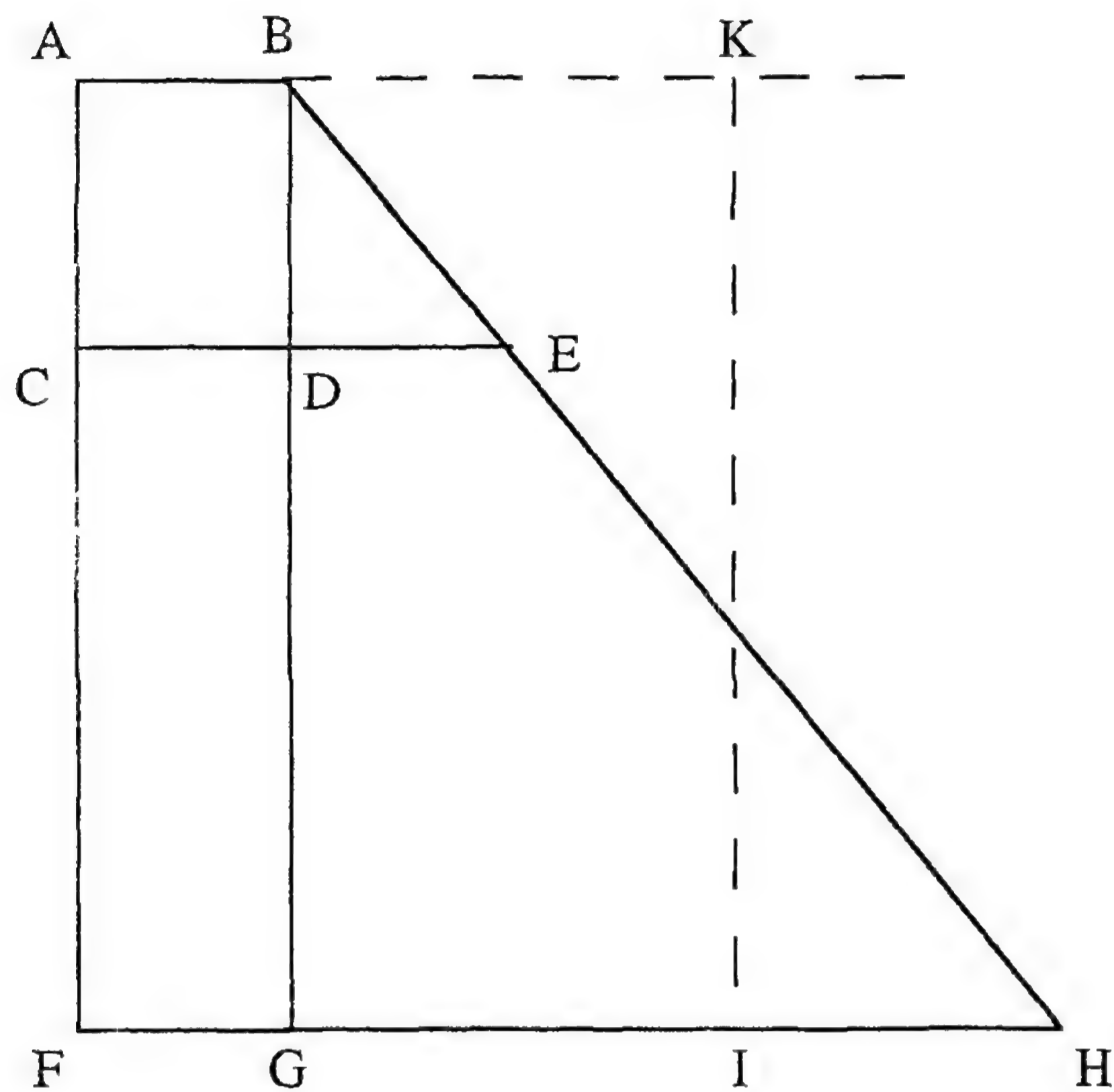


Fig. 5 Diagram illustrating difference in the 'degree of motion' of a body moving (i) with uniformly increasing motion AK, and (ii) with uniform difform motion FH, after Thomas Harriot, Mathematical Papers, British Library Add. MS 6789, f. 30r.

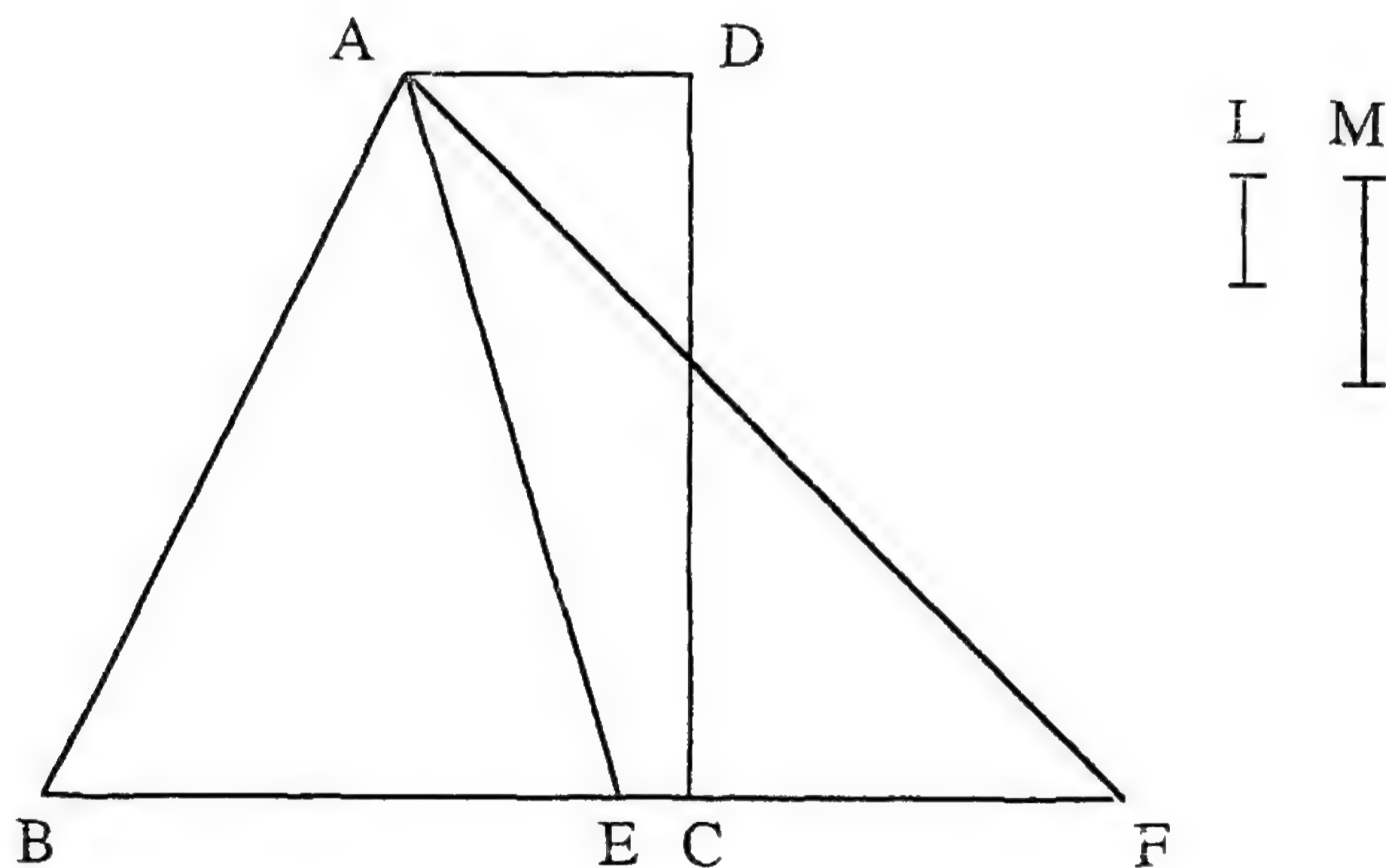


Fig. 6 Muhammad Al-Baghdadi's method for the proportional division of a quadrangle, after Federico Commandino, De superficierum divisionibus Liber Machometo bagedino ascriptus Nunc primum Ioannis Dee Londiniensis & Federici Commandini Vrbinatis opera in lucem editus. Federici Commandini de eadem re Libellus. (Pisauri: Hieronymum Concordiam, 1570), Proposition 8, Problem 8.

triangles between parallel lines as defined by Euclid. These demonstrations are devised for purely geometrical purposes, but Harriot, having described motion in terms of geometrical surfaces (after the fashion of medieval kinematics) is able to apply them directly to physical phenomena.

Like Dee in his Archimedean 'Annotation' (and unlike his medieval predecessors)¹²⁷ Harriot was not satisfied with simple description, but sought experimental verification of ballistic velocities. In the same manuscript volume as the geometrical considerations we find a collection of experimental notes concerned with the descent of a leaden bullet. By dropping a bullet 55 feet 2½ inches, and measuring the time elapsed before impact by means of pulsebeats, he extrapolated velocities for an English mile (5000 feet), presumably with a view to the practical exigencies of warfare.¹²⁸

When Husserl considered Galileo as a representative of the new physics he sought not just to 'reconstruct what consciously motivated him', but also 'to bring to light what was implicitly included in his guiding model of mathematics, even though, because of the direction of his interest, it was kept from view.'¹²⁹ What are the implicit assumptions underlying Harriot's handling of the motion of bodies? Firstly, he assumes that natural motion is 'ordinatus continue cresce[n]s, vniformely continually crescent',¹³⁰ and secondly that this uniform motion is assumed to be 'difform' (*diformis*)¹³¹ and proportional. 'The motion of any bullet downward fro[m] any point', he says, 'is still encresinge in euery poynt in continuall proportion.'¹³² By these assumptions Harriot firstly makes the motion of a body representable geometrically, and then he uses or applies geometrical rules to the physical phenomena in order to answer a physical question. As he proceeds with his ballistic work, he becomes convinced that the acceleration and deceleration of projectiles is best represented by the geometrical figure of the parabola:

The species of the line that is made vpon the shot of poynt blanke is, as is here described & is a parabola as of the vpper randons. The down randons are also paraboles continewed from the vp randons & supposing that the first velocity downeward, be the same that is for vpward. Otherwise if vp & downe be severall velocityes as they are in deed, the downe randon is a parable according to that velocity ... and is made by the continuing of ... his vpper randon of the same velocity.¹³³

¹²⁷ See Molland, 'Geometrical background', p. 123, and Murdoch and Sylla, 'The science of motion', p. 247.

¹²⁸ See Johannes Lohne, 'Harriot on ballistic parabolas', *Archive for History of Exact Sciences* 20 (1979), pp. 230-64, pp. 242-5.

¹²⁹ Husserl, *Crisis*, pp. 24-5.

¹³⁰ Add. MS 6789, f. 62r.

¹³¹ Add. MS 6789, f. 30r.: 'if the motion be vniformiter diformis crescent' [my emphasis].

¹³² Add. MS 6789, f. 62r.

¹³³ Add. MS 6789, f. 67r.

Harriot then assumes that the actual trajectory of a projectile 'is as here described, and is a parabola' – that is, the geometrical 'description' or representation and the actual existing trajectory are homologous (the trajectory *is* a parabola). Harriot strives for realism in his model: the upward and downward velocities are not equal, and the descending projectile, affected by air resistance, travels with varying velocity, making the resultant trajectory a tilted parabola.¹³⁴ Harriot notes in closing that 'the parable being made & vnderstoode continued a man <may> cut of fro[m] it the species of all randons obseruatis obseruandis.'¹³⁵ The parabola can thus be used as an explanatory model for all possible actual cases of ballistic trajectories. The direct application of diagrammatic representations (or 'analogical descriptions' as Dee called them) to physical realities was also singled out by Harriot's contemporary, and advocate of applied mathematical knowledge, the Mathematical Lecturer of the City of London, Thomas Hood, in his inaugural lecture of 1588, as evidence of the new advances in mathematics:

[I]f Geometrie reache so high that it can justly measure the Cope of heaven: no doubt on earth it performeth most excellent thinges. Let Geographie witnesse in universall Mappes, let Topographie witnesse in several Cardes, let Hydrographie witnesse in the Mariners plat ... let the Gunner witnesse in planting his shot, witnesse the Surveior in measuring land, witnesse all those that labor in mines, and those that practise conveying of water, whose skill being tolde us, we would scarcely beleeeve it, were it not lying at our doores.¹³⁶

The practical skills which Hood singles out rely on an enhanced sense of the analogical realism of the diagram – the 'mappe', 'carde' or 'plat'. Harriot believes that his diagrammatic description is identical with 'the shot' as physical reality, it is not *secundum imaginationem*, but *secundum cursum naturae*. If Piccolomini thought that mathematicians of motion were 'demonstrating through metaphors' (*demonstrare ... per metaphoras*),¹³⁷ Harriot assumes that nature itself is inherently mathematizable, and performs what Husserl calls 'the surreptitious substitution of the mathematically substructured world of idealities for the only real world.'¹³⁸

¹³⁴ See Lohne, 'Harriot on ballistic parabolas', p. 238.

¹³⁵ Add. MS 6789, f. 67r. Here and henceforth the use of arrow brackets '< >' in the quotations indicate a superlineal insertion in the original manuscript.

¹³⁶ Thomas Hood, *A Coptie of the Speache: made by the Mathematicall Lecturer, unto the Worshippfull M. Thomas Smith, dwelling in Gracious Street: the 4. of Nouember, 1588*. T. Hood (London, 1588); Johnson, 'Thomas Hood's inaugural address', p. 105. On the significance of Hood's inaugural lecture see F. R. Johnson, *Astronomical thought in Renatssance England* (Baltimore, 1937), pp. 196–205.

¹³⁷ See fn. 33 *supra*.

¹³⁸ Husserl, *Crisis*, pp. 48–9. Cf. Lohne, 'Harriot on ballistic parabolas', p. 242: 'there would have been no science of physics if its pioneers had not been allowed to idealize and simplify.'

While Harriot made great headway in the field of mathematical modelling of nature, the mathematicians of the Northumberland circle were not unanimous on the question of the status of mathematical entities. Harriot's patron, Henry Percy, writing in 1594, defined 'Arethmeticke' as 'the generall doctrine demonstratiue of proportions, to all subiects applyable', and geometry as a 'doctrine, [which] extendeth it selfe to all purposes, boeth theoricall and practicall where their is consideration of the forme, or figur of any thing.'¹³⁹ His view of astronomy as a 'siens that furniseth [us] with Hypotheses ... not arbitrary and fantastically as most of them ar giuen vs, but sutche as ar necessarely concluded, from true foundations, consonant to all the former course of philosophy'¹⁴⁰ makes it clear that he was firmly on the side of mathematical hypotheses as *certa demonstrationes* rather than convenient *suppositiones*. His client and gentleman servitor Walter Warner, however, was more ambivalent in his views on the status of mathematical models. In a recently rediscovered manuscript on planispherical geometry Warner accepts that without the 'doctrine of Triangles' there would be 'no Astronomy at <all> nor Cartography or Navigation in any perfection', and concedes that it has been 'scientifically constituted' by 'sundry moderne writers' since Copernicus. But he balks at the idea of granting this mathematical model full applicability to matter. Although these triangles are 'generally applyable to all things materiall', he says,

yet their subiects <of these extracte> are to be understood only intellectuall or intellectuallly abstracted from all materiality and the sciences themselus to be (as they are <usually> termed) merely mathematicall ... distinguishing ... these [sciences] from those ... whose subiects have their foundation and subsistence in matter and cannot by any imagination <be> abstracted from it <and> may therefore ... more properly be accomted for parts or peeces of naturall philosophy, although they be or may be by the subordinat ... application of these generall abstract sciences as scientifically formed ... [as] the sciences ... by whose borrowed help they are so formed.¹⁴¹

When Newton formulated his famous dictum 'Hypotheses non fingo', in the latter half of the seventeenth century, mathematical descriptions of physical reality were still far from unassailable. Nonetheless it is clear that during the course of the seventeenth century the idea of direct mathematical modelling in the physical sciences was successfully reformulated and retheorized in ways which were to lay the foundations for the possibility of

¹³⁹ Henry Percy, Petworth House Archive, MS 24/2, f. 27r.

¹⁴⁰ Ibid., f. 30r.

¹⁴¹ Northampton Public Record Office, Isham Lamport Manuscripts, IL 3422, VI, f. 13r-v. cf. also BL Add. MS 4395 (Walter Warner, MS Notes), f. 199, where Warner is ambivalent about applying the idea of a point 'in physicis ... where there is question de rebus' when the point is 'a thing merely doctrinall and mathematicall'.

modern physics. If, as Georges Canguilhem has argued, new theories and hypotheses in the sciences create new objects,¹⁴² the principal failure of Frances Yates' account of the emergence of the new mathematization of nature was her failure to distinguish the old and new objects. The emergence of what Husserl calls the 'mathematical manifold' brought with it a new concept of nature, a new concept of the mathematical entity, and a new concept of operation and application.

¹⁴² Georges Canguilhem, *Etudes d'histoires et philosophie des sciences* (Paris, 1968), pp. 16-17.

Gresham College and London practitioners: the nature of the English mathematical community

Mordechai Feingold

As if to commemorate the fiftieth anniversary of the opening of Gresham College, an anonymous tract, *Gresham's Ghost*, was published in London in May 1647. And yet, as its ominous title makes clear, this was to be no congratulatory volume. The author, styling himself 'Vitruvius', found nothing to commend in the institution, its trustees or its professors. With Shakespearean theatricality - though without any hint of the bard's poetic skills - he conjured up Sir Thomas's ghost to take up the 'Complaint of Seamen and other Artists' who had been wronged by the professors' disinclination to teach out of term, as well as by their failure to cater for the true needs of Londoners.¹ At about the same time, a member of the Hartlib circle (perhaps William Petty) drafted a memorandum which, while equally harsh in its appraisal of Gresham College, nevertheless put forward concrete suggestions concerning its reformation, the most telling of which was the proposal that the professorships of law and theology be abolished and new ones devoted to experiments and natural philosophy be established in their stead.²

The chorus of critics has continued ever since, invariably holding both trustees and professors responsible for botching the noble foundation of Sir Thomas Gresham. This paper will review this indictment, focusing on the Gresham professors of geometry and astronomy, in order to suggest that although the professors were indeed quick to extract more favourable terms of employment from the trustees - who, in turn, retreated from all interference in the intellectual life of the College - in many ways this recreation of an Oxbridge enclave in London was instrumental in creating a scientific centre that might not have been possible had the College become

¹ *Gresham's Ghost* (London, 1647). Another attack, utilizing the same title, appeared in 1784, where the anonymous author took his cue from Jeremiah 7:11 - 'Is this house, which is called by my name, become a den of robbers, in your eyes? Behold, even I have seen it, saith the Lord': *Gresham's Ghost, or, a Tap at the Excise Office* (Croydon, 1784).

² Sheffield University Library, Hartlib papers, 47/18/1A-2B; hereafter cited as HP.

just the training ground in elementary mathematics for artisans, merchants, and navigators that its critics envisaged. Quite simply, the unstructured nature of the Gresham College lectures and meetings allowed a free atmosphere that enabled like-minded individuals to draw together, receive instruction in the most recent scientific developments, and lay open their ideas and problems to the view and criticism of the Gresham professors as well as other practitioners. Moreover, as there never existed any prospect for Gresham College to evolve into a rival of the traditional universities,³ the contribution of the Gresham professors to the genesis of a lively community of mathematical practitioners in the capital – the members of which, in turn, disseminated their knowledge among an even larger population – can be viewed as a giant step toward providing both the element of adult education that was envisaged by Sir Thomas Gresham, and the research environment that does not appear to have been part of his agenda.

'Vitruvius', and subsequent critics, have argued that by opting to lecture only during termtime the professors violated the founder's expressed wishes. The truth is, however, that Gresham's intentions from the very start were a matter of interpretation, his will specifying only the subjects he wished to see taught in his college. Consequently, it was left to the trustees to devise the statutes, and these were utterly vague:

the geometrician is to read as followeth, viz. every Trinity term arithmetique, in Michaelmas and Hilary terms theoretical geometry, in Easter term practical geometry. The astronomy reader is to read in his solemn lectures, first the principles of the sphere, and the theoriques of the planets, and the use of the astrolabe and the staf, and other common instruments for the capacity of mariners; which being read and opened, he shall apply them to use, by reading geography and the art of navigation, in some one term of every year.⁴

Save for the mention of mariners, one would be hard pressed to distinguish these ordinances from university statutes and practices.⁵

The semblance of the proposed course of studies at Gresham College to the standing course at Oxford or Cambridge, however, hardly accounts for

³ For the difficulties encountered by new institutions of higher learning from traditional universities, see M. Feingold, 'Tradition versus novelty: universities and scientific societies in the early modern period', in Peter Barker and Roger Ariew (eds), *Revolution and continuity: essays in the history and philosophy of early modern science* (Washington, 1991), pp. 45–59.

⁴ John Ward, *The lives of the professors of Gresham College* (London, 1740, repr. New York, 1967), p. viii.

⁵ 'It will, besides, be the business of the Geometry professor', stipulated the Savilian statutes, 'to teach and expound arithmetic of all kinds, both speculative and practical; land-surveying, or practical geometry. ... It will also be the business of the professor of astronomy to explain and teach ... the whole science of optics, gnomonics, geography, and the rules of navigation in so far as they are dependent on mathematics.' Oxford University Statutes, trans. G. R. M. Ward, 2 vols (London, 1845) II, pp. 273–4.

the institution's inability to attract Londoners in great numbers to the lectures. As intimated in 1613 by John Tapp, the Gresham lectures seem to have been already by then poorly attended: '(but perhaps it may be objected unto mee thus) what good doth these publique readings which hath now beene a reasonable time continued in this Cittie, with great charge, to good purpose, but little profit as may be guessed, by the little Audience which doe commonly frequent them'.⁶ Tapp offered a partial explanation for the scarcity of audience by pointing out that 'the practisers thereof [the mathematical sciences] are few'. But this may not have been the most important reason.

Nor, to reiterate, was the crippling power struggle between professors and trustees, or the reduction in the amount of teaching required by the professors, the main source for this failure. Far more important was that by the late sixteenth century the very format of a traditional frontal lecture was becoming obsolete – even at the universities. As William Petty put it in 1647, when calling for the reformation of Gresham College, 'in these times when the Use of Printing hath made Books treating of almost all Matters in Plenty and abundance[,] There are not the same reasons for publiq Readings as of old, when Meetings of Many to heare One Man reade, was a good Remedy against the Want of those Bookes which were read'. A decade later Henry Philipps was even more explicit:

For what knowledge can be gained in this or any other Art, by the hearing a Lecture there of now and then, wherein onely some one point of the Art is treated of; though it be never so well demonstrated, if the hearer cannot have time or opportunity to hear out the whole, or liberty to ask such questions, as may be most useful for his present purpose, or most tending to his instruction in those things he doth not fully know.⁷

Elsewhere I have described the manner in which the course of study at Oxford and Cambridge was radically altered by the early seventeenth century to accommodate precisely such concerns, as the profusion of books forced the redefinition of the role of the public lecturers as well as that of the tutors.⁸ Constraints of space will not permit further elaboration on this theme other than to emphasize that such changes became particularly noticeable in the domain of the mathematical sciences. To cite Thomas Hobbes, 'even those men that, living in our universities have most advanced

⁶ John Tapp, *The Path-Way to Knowledge; Containing the whole Art of Arithmetike ... Digested into a platne and easie methode by way of Dialogue, for the better understanding of the learners thereof* (London, 1613), sig. A2v.

⁷ HP 47/18/1A; Henry Philipps, *The Advancement of the Art of Navigatton* (London, 1657), 'An Apologetical Preface'.

⁸ Mordechai Feingold, 'The Humanities', in Nicholas Tyacke (ed.), *The history of the University of Oxford IV: seventeenth-century Oxford* (Oxford, 1997), pp. 226–9.

the mathematics, attained their knowledge by other means than that of public lectures ... the true use of public professors, especially in the mathematics, being to resolve the doubts, and problems, as far as they can, of such as come unto them with desire to be informed'.⁹ That university professors of mathematics practised in such a way is well attested. When John Bainbridge, Savilian Professor of Astronomy at Oxford, recommended Henry Gellibrand to the Gresham trustees, he informed them that the latter was not only diligent in attending his lectures but 'hath by many private conferences given [Bainbridge] occasion to take notice of his singular skill in the mathematicks'. Succeeding Savilian professors were equally forthcoming in their private conferences. Seth Ward 'taught the mathematics gratis to as many of the university, or foreigners, as desired that favour of him', a routine engaged in by John Wallis as well.¹⁰

The topic of less formal instruction was often discussed in contemporary literature. In 1597, for example, while lamenting the demise of Thomas Hood's public lectures in London, William Barlow singled out for particular praise the manner in which Hood had been very 'affable to resolve beginners of their doubts'; certainly Hood himself widely advertised his availability for private instruction at the same time as he lectured. For their part, the critics of Gresham College made the issue of resolving doubts central to their accusations of negligence. The professors, insisted 'Vitruvius', 'do not do the least good, for they are so superbiously-pettish, that they will resolve no Quaere that may advantage the Dubitour'. William Petty, too, justified his sweeping claims concerning the uselessness of the Gresham lectures with the charge that 'the Readers ... doe not descend to resolve the doubts and difficulties of their Auditors'.¹¹ Small wonder, then, that already in the 1630s even the usually inactive Gresham trustees sought to ensure that their professors adhered to the new needs. Thus, prior to his institution in 1626 as Gresham Professor of Astronomy, Henry Gellibrand was made to pledge not only that 'he [would] not hereafter take any calling or course upon him, but apply himself wholly to this, or else wholly leave the place', but also that he would 'rest in the house as well in term as out of term, whereby the more commodiously to give help to gents and mariners by private conferences'. Similarly, in 1637, Gellibrand's

⁹ *The English works of Thomas Hobbes*, ed. W. Molesworth, 11 vols (London, 1839-45, repr. Aalen, 1966) VII, pp. 346.

¹⁰ Nicholas Tyacke, 'Science and religion at Oxford before the Civil War', in *Puritans and revolutionaries: essays in seventeenth-century history presented to Christopher Hill* (Oxford, 1978), p. 79; Walter Pope, *The life of Seth, Lord Bishop of Salisbury*, ed. J. B. Bamborough (Oxford, 1961), p. 25; 'Dr Wallis's letter against Mr Maidwell', *Collectanea* 1st ser., ed. C.R.L. Fletcher (Oxford, 1985), p. 320.

¹¹ William Barlow, *The navigators supply* (London, 1597), sig. K2v; *Gresham's Ghost*, 'Vitruvius to the impartial Reader'; HP 47/18/1A.

successor, Samuel Foster, was also required to promise that he would 'make this house the place of his abode'.¹²

Surely, however, charges of neglect cannot be directed at the geometry and astronomy professors. Brerewood, Briggs and their successors were exemplary in both making themselves available to all desirous of mathematical knowledge and in freely communicating their works. Not surprisingly, when Sir William Boswell opined in 1639 that the Gresham professors do little good, he excepted the mathematical professors from such universal dismissal.¹³ But it was in their capacity as mentors that the Gresham professors might be said to have succeeded in carrying out the educational mission of the College. Later commentators lamented that Gresham College never became the nucleus of a metropolitan university – not even a true precursor of adult education. Nonetheless, the professors' semi-private interaction with, and tutoring of, the more advanced practitioners in London and elsewhere in England reinforced and significantly expanded the process that was initiated by such learned mathematicians as Robert Recorde, John Dee, Leonard and Thomas Digges and Thomas Hood, and that was aimed at significantly raising the level of competency within the English mathematical community. Unfortunately, only scraps of information survive to attest to such activities by the Gresham professors. But to ignore the cumulative effect of these disparate testimonies is to neglect an extremely dynamic activity that manifested itself both in private meetings in London and in correspondence with individuals in the provinces. Thus, in addition to the familiar testimonials to the invaluable assistance provided by the Gresham professors in prefaces to books by Ralph Handson, William Bedwell and others, a wide variety of different sources attest to their involvement in additional capacities. In November 1626 the Privy Council issued an order stipulating 'That the commissioners of the Navy and Masters of the Trinity House should be made acquainted with the new scheme for measuring ships suggested by' a committee that included Edmund Gunter, Sir William Heydon, John Wells and Phineas Pett. Henry Gellibrand, together with John Wells, attested in the mid-1630s to the excellence and utility of two inventions made by Christopher de Bergh. Gellibrand was also a member of the committee, which included William Oughtred and John Selden, charged with the task of considering Captain Marmaduke Nelson's method for

¹² Ian R. Adamson, 'The administration of Gresham College and its fluctuating fortunes as a scientific institution in the seventeenth century', *History of Education* 9 (1980), p. 19; Adamson, 'The foundation and early history of Gresham College, London, 1596-1704', PhD, University of Cambridge (1975), p. 146.

¹³ 'The Professours therof who excepting few have beene very idle, should bee made at least to publish all their lectures. Only Brigs Gelebrand and some other few have beene doing any thing there.'; HP 30/4/29B.

determining longitudes. During the Interregnum, Samuel Foster and Daniel Whistler supported Henry Bond's petition to the Company of Merchants of the United Provinces requesting that Bond be allowed to board one of the Company's ships travelling to the East Indies in order to verify his alleged method for determining longitude at sea.¹⁴

These examples, with additional ones to be enumerated below, attest to the contribution made by the Gresham professors in promoting practical learning, and indicate their intimate knowledge of, and interest in, such issues. Nevertheless, to study their careers solely in terms of their contribution to navigation, surveying, instrumentation and other forms of technical assistance would be to misconstrue their vocation. Furthermore, an implicit corollary to this perception of the Gresham professors as concerned with exclusively practical matters is to regard them as virtually indistinguishable – in terms of both their outlook and their achievement – from other London practitioners, though fundamentally different from university mathematicians such as Henry Savile. As summarized by Adamson, the assumption is that none of the early Gresham professors, 'with the possible exception of Briggs, was in the forefront of scientific advance' and, in general, their mathematical work 'was practical in nature and local in relevance'. Both these claims, I believe, are exaggerated.

An episode commonly cited as evidence of the seeming divergence of approach and interest between university scholars and London (and Gresham) mathematicians, is found in the anecdote concerning Edmund Gunter's failure to become first Savilian Professor of Geometry. As related by Seth Ward to John Aubrey, Sir Henry Savile, wishing for an Oxford man to serve as his first professor of geometry, interviewed Edmund Gunter for the position. Gunter arrived

and brought with him his sector and quadrant, and fell to resolving of triangles and doing a great many fine things. Said the grave knight, 'Doe you call this reading of geometrie? This is shewing of tricks, man!', and so dismisst him with scorne, and sent for [Henry] Briggs, from Cambridge.¹⁶

The likelihood that Savile's selection may have been motivated, at least in part, by the fact that Briggs had been the renowned Professor of Geometry at Gresham College for more than twenty years, while Gunter was an ordained fellow of Christ Church, Oxford and parson of St George's, Southwark – which technically disqualified him for the position – has, to the best of my knowledge, never been taken into account. Instead, historians have

¹⁴ Calendar of State Papers, Domestic (henceforth CSPD), 1625–26, p. 475; HP 71/12/11A; CSPD, 1635–36, p. 445; HP 8/49/1A-2B.

¹⁵ Adamson, 'The administration of Gresham College', pp. 19–20.

¹⁶ John Aubrey, *Brief Lives*, ed. A. Clark, 2 vols (Oxford, 1898), II, p. 215.

found in this anecdote confirmation of the alleged contemptuous and elitist view motivating university dons, who lacked interest in, if not held outright disdain for, the utilitarian spirit that prevailed in the capital and supposedly had fostered the awakening of English science.

The contrast between university men and the practitioners was articulated recently by Stephen Johnston who opined that for the likes of Savile 'mathematics was primarily the demonstrative and textual work of the scholar. The instruments of mathematical practitioners such as Gunter appeared to Savile as trivial and superficial toys'. Furthermore, 'it was not part of the universities' function to produce mathematical practitioners'.¹⁷ Such a distinction, it seems to me, is misguided. To begin with, Briggs and other Gresham professors, such as John Greaves, were as interested in textual study of mathematics as was Savile. Briggs, after all, was the editor of the 1620 London edition of Euclid. Nor did contemporaries detect a great barrier between Gresham College and Oxbridge: not only were all Gresham professors recruited from the two universities but often they returned thither when a position became available.¹⁸

Indeed, the image of the Gresham professors as largely consumed by practical concerns is exaggerated: it is based on a misconception of the nature of some of their researches (into, for example, logarithms and magnetism) as well as on an incomplete record of their activities. The case of Henry Briggs best illustrates my point. Universally acclaimed as the architect of Gresham's practical alignment, Briggs's involvement in utilitarian matters is well documented. He advised navigators, contributed material to numerous books on practical mathematics, and served as an active member of the Virginia Company. Other activities might also be mentioned. In 1609 Briggs, together with Sir Thomas Challoner, was cast as an arbiter in the debate concerning Phineas Pett's novel proposal for a ship for Prince Henry. Two years later Briggs applied for a patent, together with Dr Daniel Selme, for an 'invention for refining lead and extracting silver therefrom, and for

¹⁷ Stephen Johnston, 'Mathematical practitioners and instruments in Elizabethan England', *Annals of Science* 48 (1991), p. 343.

¹⁸ One ought to regret the tendency to omit mentioning the tenure of Peter Turner and John Greaves as Gresham professors which has come about partly because so little is known of their activities there but partly, more ominously, because the two seem to be aberrations of the preferred 'exemplar' of a Gresham professor. It should be remembered, however, that Turner almost certainly succeeded Briggs as geometry professor at the recommendation of the latter - and he certainly would not have recommended someone he did not believe was worthy of the place - while many of Greaves's interests were commensurate with those of many Londoners, including Henry Gellibrand and Samuel Foster. For a discussion of Greaves, see Raymond Mercier, 'English Orientalists and mathematical astronomy', in G.A. Russell (ed.), *The 'Arabic' interest of the natural philosophers in seventeenth-century England* (Leiden, 1994), pp. 158-214, especially pp. 161-77.

draining lead ores and mines', promising an income of £100 to the king. Such practical involvement did not cease even after he moved to Oxford as first Savilian Professor of Geometry. In 1625 his advice was sought by the commissioners in charge of repairing the sea breaches between Great Yarmouth and Happisburgh in Norfolk, and from 1629 until his death two years later, Briggs was preoccupied with several problems of drainage.¹⁹

However, the fact that Briggs and his successors at Gresham College researched and taught such topics as logarithms and magnetism cannot be construed as proof of their exclusive commitment to utility. Rather, during the first three decades of the seventeenth century and beyond, such subjects represented the cutting edge in the mathematical sciences and natural philosophy, respectively. That both topics were capable of being immediately applied was simply an added benefit. The atmosphere of near awe that characterized the first meeting between Henry Briggs and John Napier is indicative of the genuine intellectual excitement about logarithms shared by both men. When Briggs encountered Napier, John Marr recalled years later, 'almost one Quarter of an Hour was spent, each beholding other almost with Admiration, before one Word was spoke'. Briggs himself attested to his feelings before he set off to Edinburgh: 'Napper, Lord of Markinston', he wrote to James Ussher, 'hath set my head and hands a work, with his new and admirable logarithms. I hope to see him this summer if it please God, for I never saw book which pleased me better, or made me more wonder'.²⁰ Certainly Napier regarded his invention as a major contribution to mathematics, a conviction shared by Kepler, Briggs and Gellibrand. True, an enormous computational effort went into constructing the actual tables and Briggs openly stated that he printed his early results 'for the sake of his friends and hearers at Gresham College'. Yet, acknowledging the usefulness of logarithms and the desire of those who had developed the tables to make them accessible to a wider public should in no way diminish from the fundamental theoretical research involved in the enterprise. Consequently, exclusive emphasis on Briggs's practical contributions, and statements such as 'significant though Briggs was as a mathematician in his own right, his greatest importance was as contact and public relations man' may misconstrue his own self-perception as well as the perception of his contemporaries. As Whiteside cogently points out, we know too little 'about the development of Briggs' mathematical thought' to even 'begin to guess how

¹⁹ *The autobiography of Phineas Pett*, ed. W. G. Perrin, Navy Record Society 51 (London, 1918), p. 59; CSPD 1611-18, p. 34; CSPD 1625-26, p. 168; CSPD 1628-29, p. 579; CSPD 1629-31, pp. 111, 163.

²⁰ *The last of the astrologers: Mr. William Lilly's history of his life and times*, ed. Katharine M. Briggs (London, 1974), p. 97; *The whole works of the most Rev. James Ussher, D.D.*, ed. C. R. Elrington, 17 vols (Dublin and London, 1847-64), XV, p. 90.

highly he thought of his square-root method' beyond 'computing convenience'. 'It is clear, however', Whiteside continues, that in the lengthy introduction of his *Arithmetica logarithmica* Briggs made among other things 'a profound study of the n^{th} -order finite differences' and that his 'unwillingness to commit his methods to print contributed without doubt to the general lack of recognition of Briggs' mathematical worth in the seventeenth century and with his death interest in the theory of tabular interpolation lapsed till the 1660s, when it was revived' especially by James Gregory and Isaac Newton.²¹

Taking a step further, my claim that the issues engrossing the attention of the early Gresham professors represented the cutting edge of contemporary research, I should like to argue that their public lectures resembled the practice at Oxford and Cambridge in yet another way. The lectures served, at least in part, as a platform from which the results of their current investigations were communicated to an appreciative audience of adepts, who had already been well grounded in the mathematical sciences. In so doing, Briggs's and Gellibrand's lectures heralded those better known lectures delivered by Samuel Foster, Lawrence Rooke and Christopher Wren during the 1640s and 1650s - lectures that were followed by less formal meetings in the professors' quarters at Gresham College and that gave rise to the foundation of the Royal Society.

Once we recognize the need to consider the Gresham professors of geometry and astronomy as more than just applied mathematicians, it follows that assumptions concerning the gulf that separated their philosophy of mathematics from the one held by 'scholarly' university mathematicians are in need of modification. It has been argued that what distinguished the non-university practitioner from the scholar was the extensive utilization of instruments by the former and their far less rigid insistence on broad theoretical knowledge as a prerequisite to the use of instruments in mathematical instruction. Instead, I would argue, there actually existed a unanimity of opinion between the perception of the Gresham professors, and other teachers of mathematics in London, and Oxbridge mathematicians about the need to inculcate the principles upon which the instruments were constructed, and to ground practice firmly on art. Edmund Wingate's account of the reasons animating Edmund Gunter's failure to publish a manual for those using his logarithmical scale rule is telling:

²¹ Christopher Hill, *Intellectual origins of the English revolution* (Oxford, 1965), p. 38. For brief assessments of Briggs's contribution see H. W. Turnbull, 'James Gregory: a study in the early history of interpolation', *Proceedings of the Edinburgh Mathematical Society* 2nd ser., 3 (1933), pp. 164-70; Derek T. Whiteside, 'Henry Briggs: the Binomial Theorem anticipated', *Mathematical Gazette* 45 (1961), pp. 9-12; Whiteside, 'Patterns of mathematical thought in the later seventeenth century', *Archive for History of Exact Sciences* 1 (1961), pp. 232-6.

He did forbear to explain that use thereof, because he took it for granted that none would meddle with it, but such onely as were already well able to understand how to number upon it, having beforehand acquainted themselves with the manner of numbering upon Scales, and with the nature of Logarithms: For, when . . . I importuned him to make a fuller explanation how to number upon it, to the end the use thereof might by that means be made more publick, his answer was, That it could not be expected the Rule should speak: Intimating thereby, that the Practitioner should (in that point) rely much upon discretion, and not altogether depend upon precepts and examples.

Turner is certainly right to conclude that Gunter's attitude was indicative 'of a desire that instruments should be used as aids in calculation only by those who understood the mathematical principles on which they depended and not as a way of solving calculations without understanding'. Nor was Henry Gellibrand's attitude much different. In his *Epitome of Navigation* he sneered at a certain mathematical teacher – almost certainly Richard Delamain – 'who gave his pupils the answers to mathematical problems with neither proofs nor manner of working: "I told him that was not Artist like . . . advising him to mend his Answer by a Demonstration, or at least the Rule he wrought it by"'. The 'badgered man could only reply that his answer was "near enough"'.²² Surely there is little to differentiate the outlook of the Gresham professors from that held by William Oughtred. As cited by his student William Forster, Oughtred insisted that

the true way of Art is not by Instruments, but by Demonstration: and that it is a preposterous course of vulgar Teachers, to begin with Instruments, and not with the Sciences, and so instead of Artists, to make their Schollers only doers of tricks, and as it were Juglers; to the despite of Art, losse of precious time, and betraying of willing and industrious wits, unto ignorance, and idlenesse. That the use of Instruments is indeed excellent, if a man be an Artist: but contemptible, being set and opposed to Art.²³

Consequently, we should be cautious not to characterize Oughtred's (and Savile's) verdict on instruments quickly as a manifestation of the elitist and disdainful attitude exhibited by scholars vis-à-vis mathematical practitioners.

²² Edmund Wingate, *The Use of the Rule of Proportion in Arithmetick and Geometry* (London, 1658), Sig. A5; A. J. Turner, "Utile pour les Calculs": the Logarithmic scale rule in France and England during the seventeenth century', *Archives Internationales d'Histoire des Sciences* 38 (1988), p. 254; E. G. R. Taylor, *The mathematical practitioners of Tudor and Stuart England* (Cambridge, 1954), p. 74.

²³ *The circles of proportion and the horizontal instrument. Both invented, and the uses of both written in Latine by ... Mr. W.O. ... Tr. into English: and set forth for the publique benefit by William Forster* (London, 1632), sig. A3. For Oughtred's own lengthy contribution see his 'To the English Gentry', appended to the 1633 edition of *The circles of proportion ...*

Not only were the Gresham professors akin to university mathematicians in their perception of the 'proper' relationship between theory and practice, but their writings, too, had an informed readership, not the 'vulgar', in mind even when they published practical treatises. And it was the task of their friends and disciples among the London practitioners to popularize their ideas. To give but one example: William Fisher, who in 1674 edited Gellibrand's *Epitome of Navigation*, informed the reader he had originally intended to reprint the author's *Institutions Trigonometrical*. But believing that this book 'was somewhat obscure, and besides contained nothing of the Use and Application of Triangles in the three kinds of sailing, and for this reason not so proper for Seamen' he changed his mind and prepared a pot-pourri of material derived from Gellibrand's *Epitome*.²⁴ Not surprisingly, an early eighteenth-century critic of the College found the instruction of the professors too specialized and unsuitable for most Londoners – a further evidence of which he saw in the near sameness between the College and the Royal Society:

And altho' the Royal Society therein residing, have contributed very much by their learned Labours and Discoveries, to the Benefit of Mankind; yet being as it were confined to a narrow compass, and chiefly suited to those of a Superior Class (Spirits of the most exalted Nature) and so not so well adapted to those of a lower Orb, whose Capacities cannot suddenly attain to Speculations of so sublime and abstruse a Nature, as those wherein they are conversant; yet doubtless, this excellent Person's Design was, That Learning and Ingenuity should be propagated in a more diffusive Manner, and so as it might be insinuated into the meanest Capacity, who by a frequent Attendance and Application, might insensibly imbibe those Principles of good Literature, which none but the most refined Spirits could attain to of a sudden.²⁵

In the light of my claim that to a significant extent Gresham College neither failed to fulfil its instructional mission – at least in the domain of the mathematical sciences – nor failed in its added capacity to serve as a research institution, how then do I account for the rapid demise of even the Gresham lectures of astronomy and geometry during the second half of the seventeenth century? Evidence for such decline can easily be inferred from Hooke's occasional remarks during the 1670s that he had either but a few auditors or none at all.²⁶ Similarly, when John Flamsteed was appointed in 1681 to substitute for Walter Pope as Gresham Professor of Astronomy he

²⁴ Henry Gellibrand, *An Epitome of Navigation with a Table of Logarithms* (London, 1674), sig.A2. There exists no copy of the work published during Gellibrand's lifetime.

²⁵ 'A Representation of the Case of Gresham College, relating to the Lectures there' (London, 1706), incorporated into *An Account of the Rise, Foundation, Progress and Present State of Gresham-College in London* (London, 1707), p. 23.

²⁶ See, for example, *The diary of Robert Hooke*, ed. Henry W. Robinson and Walter Adams (London, 1935, repr. 1968), pp. 47, 86.

apologized to William Molyneux for not writing on account of his needing to prepare 'for the almost ruined Gresham lectures'. His correspondent promptly responded:

I am hartily sorry to hear you Call [the Gresham lectures] allmost Ruined, Truly tis Pitty so Noble a designe should fall to the Ground. And tis a shame for the Gentry of London to suffer the Great Professors of that College to Read sometimes to almost Bare Walls. Were a seditious balling Fanatick in the Pulpit he would have a Thick Audience to hear his Informal Doctrine, Whilst the Caelestiall Discourses of a Learned Astronomer or Other Mathematician are heard but by a Few, and perhaps by them Neglected.²⁷

An obvious culprit for such a decline, if an inadvertent one, I shall argue, was the Royal Society, and I shall discuss its role below. Before doing so, however, I would like to mention two equally important contributing factors. First, before the Civil War Gresham College was unique in providing a true public sphere in London. The centrality of its location, the spaciousness of its structure, the permanence of its establishment, and the real sense of its being open to all who cared to come, together made it far more suitable for the meeting of like-minded individuals than any one person's lodging. Indeed, the uniqueness of the place and the success of its meetings may have been responsible for Archbishop Laud's mistaking the meetings at Gellibrand's quarters for 'conventicles'.²⁸ After 1660, London witnessed a proliferation of coffee houses and similar institutions, which not only rendered the unique contribution of Gresham College as a public space unnecessary, but even threatened the meetings of the Royal Society itself as they became the meeting places of choice for scientific instruction, public demonstrations, and even meetings of the members of the Royal Society.

Second, by the second half of the seventeenth century the educational task of the Gresham professors was largely complete. Over the previous six decades they had helped raise two or three new generations of mathematical practitioners, and the latter were now in a position to sustain the

²⁷ Responding to this, Flamsteed was more optimistic: 'But I hope the times under Good laws will mend. If you Count not men as you doe fagots, by tale [number], I have as good an Auditory at Gresham Colledge as most were in the Now expiring Meeting houses and I doubt not but that men tired with noysome debates will ere long turne to more ingenuous and lesse harmefull studies'; *The correspondence of John Flamsteed, the first Astronomer Royal*, ed. Eric G. Forbes, Lesley Murdin, and Frances Willmont, 3 vols (Bristol and Philadelphia, 1995-) I, pp. 828, 840, 851. By 1683 there were hardly any auditors, and when more than a handful showed up it was, according to Flamsteed, the result of an effort by Hooke to sabotage the lectures. See *The Gresham lectures of John Flamsteed*, ed. Eric G. Forbes (London, 1975), pp. 4-5.

²⁸ Francis R. Johnson, 'Gresham College: precursor of the Royal Society', *Journal of the History of Ideas* 1 (1940), pp. 413-38, on p. 435. Sometime in 1636 Laud also requested Sir Nathaniel Brent to confer with Sir John Lambe and 'draw up articles for an archiepiscopal visitation of Gresham College'; CSPD, Charles I, 1636-37, p. 261.

community independent of either the Gresham professors or the universities. It is noteworthy, however, that mathematical practitioners with university backgrounds continued to exert disproportionate influence on the London community well into the eighteenth century.

Fortunately for Gresham College, the making of its old services obsolete coincided with the establishment there of the Royal Society. This offered the College a new lease on life: so much so, indeed, that after 1660 the College came close to losing its own identity and became virtually indistinguishable from the Royal Society. Even the trustees came to recognize such a turn of events and, consequently, were compelled to make serious efforts to keep the Society at the College in the hope that some of its lustre would rub off on the Gresham lectures as well. Thus, despite the shortage of space after the great London Fire, they allowed the Society to keep its repository at the College. More significantly, in 1674, after the Society had been in exile at Arundell House for more than seven years, the trustees formally invited the members to resume their meetings at Gresham College. The timing of the invitation was perhaps not unrelated to the serious efforts undertaken just then by the Society to reform its meetings and acquire its own home.²⁹ Quite possibly, then, in an effort to sweeten their offer, the Gresham trustees agreed to an extraordinary expenditure of £40 to Robert Hooke, so 'that a small turret might be built over part of his lodgings; which is greatly wanted as for the trial of certain instruments by him invented as for taking observations of the stars'. Indeed, Hooke was further rewarded for being virtually alone in attending to his duties as Gresham Professor for, in October 1680, when the trustees suspended the salaries of the professors, they agreed to exempt Hooke, 'finding that he only of all the professors hath been constantly resident, and for all that appears hath been ready to read when any auditory appeared, and besides hath printed many of his lectures for the common benefit, the committee thereupon dissolved the suspension as far as concerned him'.³⁰ Subsequently, in 1686, the routinely close-fisted trustees resolved on an additional expenditure,³¹ having concluded that to 'procure a constant audience' it was necessary

to repair and beautify the common dining rooms and withdrawing rooms at Gresham College and to give leave to the gentlemen of the Royal Society to make use thereof during the pleasure of this committee desiring them that their meetings will always be in term time and at such times as the reading of the seven lectures are appointed ... and that they encourage the said lectures

²⁹ Michael Hunter, *Establishing the new science: the experience of the Royal Society* (Woodbridge, 1989), pp. 123-244.

³⁰ Adamson, 'The foundation and early history of Gresham College, London,' pp. 223, 226.

³¹ Ian Adamson, 'The Royal Society and Gresham College 1660-1711', *Notes and Records of the Royal Society of London* 33 (1978), pp. 4-7.

as much as they can. Which we hope will be a means to make the said lectures to answer the intent of the worthy founder.

By 1700, however, the relations between College and Society had turned sour. The Gresham trustees, pleading penury, wished to tear down Sir Thomas's old house and use part of the proceeds from the sale of such prime property to build a much smaller college. To their chagrin, until his death in 1703, Robert Hooke was quite successful in thwarting all the trustees' efforts to obtain the necessary act of Parliament. Later the Royal Society itself took control of the campaign against the trustees, since the Gresham trustees had made no provisions in the proposed bill to accommodate the needs of the Society. In fact, the Society was informed in 1704 that it should no longer count on Gresham College for its home. It also seemed that most Gresham professors, who stood to benefit handsomely from the proposed relocation, also turned against the Society, for Edward Lhwyd wrote to Bishop Nicolson in 1705 that 'the professors of Gresham College are in a Confederacy against the Royal Society'.³²

Ultimately, the Gresham trustees failed to get their way, and were prevented from taking possession of the site upon which Gresham College stood. Yet, no sooner had the Royal Society won its battle that its secretary and president decided to move out. Sir Hans Sloane was keen to do so as a consequence of his bitter feud with the Gresham Professor of Physic, John Woodward, while Newton sought to consolidate his hold over the Society by obliterating all ties with the place that had housed Hooke for nearly half a century. One member of the Society who opposed the move published 'An Account of the late Proceedings in the Council of the Royal Society, in order to remove from Gresham College into Crane Court', in which it was related that on 1 September 1710, prior to a regular Council meeting, Newton convened a special general meeting and informed the Fellows of the need to move to another location. Apparently not a few of the Fellows present raised queries and objections, yet Newton 'was not prepared to enter upon that debate', saying only that 'he had good reasons for their removing, which he did not think proper to be given there'. For his part Sloane, 'who has engross'd the whole management of the Society's affairs into his own hands, and despotically directs the President, as well as every other member', attempted to impress upon the members that the Gresham trustees wanted them out. Many remained unconvinced, but Newton and Sloane carried the day.³³

³² Adamson, 'The Royal Society and Gresham College', pp. 8-14; *The London diaries of William Nicolson Bishop of Carlisle 1702-1718*, ed. Clyve Jones and Geoffrey Holmes (Oxford, 1985), p. 274.

³³ Charles R. Weld, *A history of the Royal Society*, 2 vols (London, 1848, repr. New York, 1975), I, p. 391-4.

The dissolution of the union with the Royal Society forced Gresham College to scramble for a new identity, as well as for auditors. After all, as one shrewd observer made clear, 'it must be acknowledged to the Honour of the Royal Society, that Gresham College has not been altogether barren and unfruitful; but as that Illustrious Body has been the main, if not the only occasion that this Colledge has not by this time lost its name, so the Lectures that were at any time read there, were chiefly, if not wholly for their account, and upon another Foundation'. But the task proved impossible and all that John Woodward could do in the late 1720s was to reflect nostalgically on the old college whose fame

went over the whole world. The most important discoveries of those times took their rise from Gresham College... . There's hardly any part of useful knowledge that has not received great accessions from thence; and some of the most considerable discoveries in philosophy, physic, anatomy, in all the parts of mathematics, in geometry, in astronomy, in navigation, came forth of Gresham College. ... We feel them in our persons, in our health, in the enlargement of our minds, in our strength by sea and land, as well as in our power and interest abroad.³⁴

Unfortunately, recollections on former glory could not support an old, dilapidated building, and in 1768 the trustees finally managed to obtain an act of parliament and tore the College down. John Ward was right, then, when he wrote in 1740 that the 'year 1710 proved very unfortunate to the college, by the removal of the royal society'.³⁵

³⁴ Hill, *Intellectual origins of the English revolution*, p. 61.

³⁵ Ward, *The lives of the professors of Gresham College*, p. xviii.

Christopher Wren's Greshamite history of astronomy and geometry

Jim Bennett

In 1657 Christopher Wren became Professor of Astronomy in Gresham College, a post he held until the early months of 1661 – a relatively short period in a long career, but one of the most varied, productive and exciting Wren experienced before, through the burden of official office, he came to specialize in the branch of practical mathematics with which he is generally associated today.

It was the first appointment for a young man of whom great things were expected. It came through the influence of his mentors and the intervention of the head of state. Wren was only twenty-five and this was an unusual and unexpected appointment, possible in these circumstances because he was generally considered, as John Evelyn put it, a 'miracle of a youth'.¹ The more severe judge, William Oughtred, had publicly announced the promise of 'great things' from Wren, when in the preface to the 1652 edition of his *Clavis mathematicae*, he acknowledged that this 'youth generally admired for his talents' had already enriched practical mathematics with 'brilliant inventions'.² Anticipation was intense.

It was not simply Wren's first appointment: for the first time he was free to set his own agenda, his mathematical and natural philosophical interests having previously been strongly influenced by powerful figures – first in his family (Dean Christopher Wren in particular) and then at Oxford (particularly John Wilkins). Now Wren had to establish his own programme, with appropriate accommodation for his duties and the traditions and ethos of Gresham College.

There are two aspects to the present account of Wren's Gresham programme. One is the record, so far as it exists, of what he actually did; Wren was never good at leaving traces of his activity. The other is his own

¹ E.S. de Beer (ed.), *The diary of John Evelyn* (Oxford, 1955), III, p. 105.

² W. Oughtred, *Clavis mathematicae* (Oxford, 1652), preface; V. Fuerst, *The architecture of Sir Christopher Wren* (London, 1956), note 802.

anticipation of his programme, recorded in the inaugural lecture he gave in 1657. This survives in two versions: an English draft and a Latin text.³

We can consider first what Wren did and what happened around him during his tenure. The intervention, referred to above, by the head of state concerns Cromwell's instruction to the Committee of the City of London for Gresham College that the appointment of a successor to Daniel Whistler as professor of geometry be halted – an instruction issued on the very day the election was due.⁴ Circumstantial evidence links John Wilkins, who had recently become Cromwell's brother-in-law, with this intervention and in the same month Robert Boyle was saying that Wren was the likely successor to Whistler.⁵ Wren was also known to Jonathan Goddard, Professor of Physic at Gresham College and physician to Cromwell, and to Laurence Rooke, the Professor of Astronomy. In the event Rooke moved to Geometry and Wren was appointed Professor of Astronomy.

We know that during his relatively short tenure Wren collaborated with Paul Neile on telescope building and that in 1658 together they mounted a 35-ft telescope in the College courtyard. In the same year Wren wrote his treatise on Saturn, *De Corpore Saturni*, containing his solution to the great telescopic problem of the age – the physical model for Saturn that could give rise to its puzzling succession of telescopic appearances. We know that Wren presented his solution in a lecture at Gresham – an occasion that was later remembered by Fellows of the Royal Society – and we know that a brass model was made and incorporated into the mount for the telescope.⁶

Also in 1658 Wren solved the mathematical challenge known as the 'Jean de Montfert problem', which derived from the geometry of the ellipse, and was successful in his work on rectifying the cycloid, as well as the semicubical parabola. He also that year found a geometrical solution to 'Kepler's problem', which was required for the application of the area law to finding a planet's position in its elliptical orbit. He gave lectures at Gresham on Keplerian astronomy and in 1659 we know that he offered lectures on telescopes. His lectures, as is well known, together with those of Rooke, were the occasion of meetings of mathematicians and natural philosophers from 1658, and of discussions in weekly sessions following

³ The English draft is in C. Wren, Jnr, *Parentalia: or, Memoirs of the Family of the Wrens* (London, 1750). The Latin text is in J. Ward, *Lives of the Professors of Gresham College* (London, 1740), pp. 199–206. On account of the frequency of the quotations from the English draft and the few pages it covers in *Parentalia*, page references for individual quotations will not be given.

⁴ T. Carlyle (ed.), *The letters and speeches of Oliver Cromwell* (London, 1904), II, p. 493.

⁵ These circumstances are considered in J.A. Bennett, *The mathematical science of Christopher Wren* (Cambridge, 1982), pp. 20–1.

⁶ The details and references for these and all the other projects of Wren's referred to in this article can be found in Bennett, *Mathematical science*.

the lectures. On the one, famous, occasion when their names were recorded – the foundation of the Royal Society, 28 October 1660 – the audience was impressive, for it included Boyle, Wilkins, Neile, Rooke and Goddard, as well as William Brouncker, Robert Moray, William Petty, William Ball and Abraham Hill.

Wren was also one of a separate group of 'mathematical friends' meeting regularly in London in 1658, who included Brouncker, Goddard, Neile and Rooke, as well as Charles Scarburgh and the instrument maker Anthony Thompson. Wren collaborated with Rooke on experiments to establish the laws of elastic collision, and he devised a mathematical formalism to calculate the results of such collisions. This formalism was among the things discussed with Christiaan Huygens, who visited Wren while he was still at Gresham – just – in April 1661, and found that Wren was able to predict successfully the results of Huygens's own experiments. Another famous, and even more unexpected, visitor was the King himself in October 1660, when Charles came to look through Wren's telescope – 'to his very great satisfaction', according to Samuel Hartlib.⁷ Considering the difficulties the Royal Society had subsequently in trying to persuade the King to visit his academy, this was a significant recognition.

These examples of Wren's activity are only those that can be *securely* attributed to his Gresham period. While there are further likely candidates, we already have sufficient evidence that Wren was energetic, creative and successful. He was now more than a promising youth: he had a European reputation. By way of self-commentary, what light can be thrown on Wren's Gresham work by his own inaugural lecture? First, what is the relationship between the two versions? They are basically similar in content, but where there are differences, the English version is the more outspoken, vigorous and enthusiastic, the Latin more cautious and circumspect.

We can consider, for example, the political and religious content. Despite the staunch Royalist traditions of Wren's family, it is perhaps not too surprising, in the light of his appointment through Cromwell's intervention, to find him writing in the English version that with the coming of the Copernican hypothesis '... began the happy Appearance of Liberty to Philosophy, oppress'd by the Tyranny of the Greek and Roman Monarchies'. In the Latin text we have simply 'Et jam primum philosophiae, Graecorum tyrannide oppressae, restituta libertas illuxit', with no reference to monarchy.

Again, in connection with the development of the Copernican debate, Galileo is said to have been important for his demolition of the Ptolemaic hypothesis – his use of evidence and telling argument to kill the old. William

⁷ J. Crossley (ed.), *The diary and correspondence of Dr. John Worthington* (Manchester, 1847), I, pp. 126–7.

Gilbert, on the other hand, took positive steps to build a new system, through his cosmic magnetism and its influence on Kepler, '... so that if one be the Brutus of Liberty restor'd to Philosophy, certainly the other must be the Collatinus'. While Brutus killed a potential tyrant, Collatinus, the husband of Lucretia, represents the just revenge on and execution of Sextus Tarquinius and the overthrow of a tyrannical monarchy. None of this survives into the Latin version.

The significance of Gilbert also is eventually stated with more circumspection. In the English version he is an absolutely pivotal figure, 'the Father of the new Philosophy', while Descartes is 'but a Builder upon his Experiments'. In the Latin lecture Gilbert is still important, but Descartes and now Gassendi 'et plurimi alii' are introduced first and dealt with in passing, before we hear of the achievements of Gilbert. Again the English version seems fuller, more enthusiastic, more extravagant, the Latin more circumspect and less bold – the result, perhaps, of a steadying hand and an older head.

Finally, the Latin version drops Wren's attempts to show how astronomy can explain miracles, such as the dial of Ahaz whose shadow was made to reverse its direction of movement as a sign to King Hezekiah (II Kings 20; Isaiah 38), and properly interpret the statement that Christ would remain in the tomb for three days and three nights when the New Testament sequence of events accounts for only a day and a half. Clearly these were unnecessary and imprudent hostages to fortune. So, of the two versions, we can consider the English more candid, more revealing, and more in tune with Wren's own more spontaneous thoughts and hopes as he took up his appointment. It is worth noting too that it survived in the family papers, while the Latin text came to John Ward through another source.

The inaugural lecture, and particularly the English draft, shows that Wren had an impressively coherent vision, comprising a programme for the development of mathematical science and natural philosophy, placed in the context of a particular construction of the past. It was a 'history' in the seventeenth-century sense – the sense of Wren's friend Thomas Sprat's *History of the Royal Society* – it recruited the past to account for and justify a particular view of the present and a programme for the future. It was in this sense that it was a 'Greshamite' history.

Among several important nodes in Wren's history, such as 'magnetics', Gilbert, and Gresham College, Wren establishes at an early stage the foundational character of mathematics:

Mathematical Demonstrations being built upon the impregnable Foundations of Geometry and Arithmetic, are the only Truths, that can sink into the Mind of Man, void of all Uncertainty,

and, immediately and more significantly,

all other Discourses participate more or less of Truth, according as their Subjects are more or less capable of Mathematical Demonstration.

So, mathematics is the touchstone of truth and offers a universal method for science - science in the seventeenth-century sense of organized knowledge. The implication is that the science of natural philosophy should become in some manner mathematical, just as that of astronomy already was.

How was this to be achieved in the case of natural philosophy? Wren addresses the question directly, though not very fully:

... natural Philosophy having of late been order'd into a geometrical Way of reasoning from ocular Experiment, that it might prove a real Science of Nature, not an Hypothesis of what Nature might be, the Perfection of Telescopes, and Microscopes, by which our Sense is so infinitely advanc'd, seems to be the only Way to penetrate into the most hidden Parts of Nature, and to make the most of the Creation.

He also says that mathematics is the great '*organ organon* of all infallible science'. So mathematics is to be incorporated into natural philosophy both as a technique and as a model of sound and structured inference. The natural philosophical character of this type of inference depends on the enhancement of the senses through the use of instruments. Only experiment - 'ocular experiment' - can be the basis of this reasoning process, if it is to yield 'a real Science of Nature' rather than mere hypothesis. Since it cannot develop through speculation or imagination, it is only by 'seeing' beyond the natural limits of vision that this natural philosophy can progress.

The microscope and the telescope, both of which Wren would use in the following years, were thus new instruments for natural philosophy; previously instruments had been the characteristic tools of mathematical science. Robert Hooke later echoed just this package of ideas: the plain, unvarnished view of material things replacing the fancy and imagination, optical instruments as the necessary adjunct to the senses, and a geometrical form of reasoning from these enhanced experiences regulated by his 'philosophical algebra'.⁸ It is worth noting that Descartes is not acknowledged in the context of the geometrical method in natural philosophy, and Bacon is not so much as mentioned in the whole lecture. As we have seen, in the English version Descartes' thought derives from Gilbert, while in the Latin he is merely referred to with Gassendi and 'many others' as a contributor to the new philosophy.

It is Gilbert who plays the central, pivotal role, and magnetics that has provided the crucial novelty, connecting astronomy, experimental natural

⁸ R. Hooke, *Micrographia* (London, 1665), preface.

philosophy and the mathematical arts. It is when astronomy incorporated magnetism – ‘a Kind of Terrestrial Astronomy, an Art that tells us the Motions of our own Star we dwell on’ – that Wren identifies a new beginning: then, he says, ‘were the Gates of true Science open’d’.

What can Wren have meant by referring to the motions of our own star in this context? There are clues to the answer when he later reminds his audience that Kepler founded his elliptical astronomy on Gilbert’s notion of a magnetic earth moved by magnetic force. He assures them also that the completion and perfection of the elliptical astronomy is ‘... to be expected from Men of our own Nation at this Day living, and known to most of this Auditory’. The perfection of the telescope was similarly anticipated from the current work of Englishmen.

The crucial ingredient in this perfection of magnetical astronomy was surely the variation of the variation, the discovery in the 1630s by Henry Gellibrand, Gresham Professor of Astronomy, that the magnetic variation changes over time – ‘a Thing, I confess’, Wren said, ‘as yet crude, yet what might prove of Consequence in Philosophy’. A more complete account of secular changes in variation would discover any systematic alterations, and these would be relevant to refining a theory of planetary motion based on magnetic dynamics, such as that of Kepler. At the very same time, Wren was engaged on a long-term study of variation, using a very long needle of 40 inches, so as to magnify any changes. He specifically linked this with the astronomical cycle, by telling William Petty that his hope was ‘to discover the Annual Motion of Variation & Anomalies in it’.⁹

These were exciting prospects. But it was not only planetary theory that the variation of the variation promised to perfect: the very year of Wren’s lecture seemed to offer the prospect of a solution to the longitude problem based on the same phenomenon. Since the 1630s Henry Bond had been predicting in *The Seaman’s Kalender* that the variation would decrease from its easterly value in London to reach zero in 1657.¹⁰ He also claimed that his account of the Earth’s magnetism that yielded the prediction also provided a method for finding longitude at sea. When Bond’s prediction for 1657 proved correct, the prospect of the longitude method raised excitement and anticipation. Wren was able to tell his audience that the variation of the variation

might prove ... of so great Use, possibly to the Navigator, that thereby we may attain the Knowledge of Longitudes, than which, former Industry hath hardly left any Thing more glorious to be aim’d at in Art.

⁹ J.A. Bennett, ‘A study of Parentalia, with two unpublished letters of Sir Christopher Wren’, *Annals of Science* 30 (1973), pp. 129–47, see p. 147.

¹⁰ E.G.R. Taylor, *The mathematical practitioners of Tudor and Stuart England* (Cambridge, 1970), p. 352.

Gilbert, Gresham and London are the historical nodal points that Wren seeks to map on to the conceptual and methodological nodal points we have already noted – mathematics (including astronomy and the mathematical arts), magnetics and experimental natural philosophy (including the use of instruments). Gilbert appears in this account, as Wren puts it, 'not only as the sole Inventor of Magneticks, a new Science to be added to the Bulk of Learning, but as the Father of the new Philosophy'. The foundation of his achievement lay in his devotion to experiment: he spent 'his Studies and Estate' in securing the liberty Copernicus offered to philosophy, and the focus of his method was his 'many admirable magnetical Experiments'.

There are figures beyond the shores of England whom Wren wishes to include at the centre of his history, and not relegate to the sidelines like Descartes; they are Galileo and Kepler. Thus Gilbert has to be linked to each of them. In the case of Galileo we are told that Gilbert maintained a correspondence with Franciscus Sagredus, the Sagredo of the *Dialogo* and the *Discorsi*. We are also told, as we have seen, that Galileo and Gilbert were a complementary pair of natural philosophers, offering respectively negative and positive contributions but both advancing the cause of Copernicanism, as well as being complementary in their subject matter:

... the one hath given us an exact Account of the Motion of Gravity upon the Earth; the other of the secret, and more obscure Motion of Attraction and magnetical Direction in the Earth.

In the case of Kepler the link is considerably less strained, for he acknowledges the importance of Gilbert's influence in the *Epitome of Copernican Astronomy*. As Wren says, Gilbert gave '... Occasion to Kepler (as he himself confesses) of introducing Magneticks into the Motions of the Heavens, and consequently of building the elliptical Astronomy'.

If Gilbert and his magnetics had established the British, indeed the London, focus for philosophical liberty, this was secured by Gresham College and the variation of the variation. Wren is now able, having arranged the pack himself, to play the Gresham card. He first cites the College's reputation for practical mathematics, since the professors had been 'Men of the most eminent Abilities, especially in mathematical Sciences; among whom the names of Gunter, Brerewood, Geillibrand, Foster, are fresh in the Mouths of all Mathematicians'. Then he brings them into his story through their work of developing previous British initiatives,

Amongst which, the useful Invention of Logarithms, as it was wholly a British Art [a reference to John Napier of Edinburgh], so here especially receiv'd great Additions: and likewise, the whole Doctrine of Magneticks, as it was of English Birth [a reference to Gilbert], so by the Professors of this Place was augmented by the first Invention and Observation of the Mutation of the magnetical Variation.

It is here that Wren points to the importance of variation for natural philosophy and for finding longitude. So, having allowed his story to spread out from Gilbert to include Galileo and Kepler, he now pulls it back in to a focus on Gresham College itself, with the particularly happy example of an experimental and instrumental measurement that linked the mathematical art of navigation with the experimental natural philosophy of magnetism and even incorporated the suggestion of a solution to the longitude problem.

This allows Wren to conclude with an extensive rhetorical flourish in praise of London as the principal centre for this exemplary science – a centre second to none, not excluding Oxford and Cambridge:

Mercury hath nourish'd it in mechanical Arts and Trade, to be equal with any City in the World; nor hath forgotten to furnish it abundantly with liberal Sciences, amongst which I must congratulate this City, that I find in it so general a Relish of Mathematicks, and the *libera philosophia*, in such a Measure as is hardly to be found in the Academies themselves.

Wren ends with a Greshamite hope that London might be the global centre for navigation, or, as he puts it, 'an Alexandria, the establish'd Residence of Mathematical Arts'.

To some extent Wren was playing to the gallery and telling his audience what they wanted to hear, but it is worth noting the accuracy of what he proposed for his own programme of work at the College. In this context he mentions three things:

... of all the Arguments which the Learned of this inquisitive Age have busy'd themselves with, the Perfection of these two, Dioptricks [the telescope and microscope], and the Elliptical Astronomy, seem most worthy our Enquiry,

while adding, in connection with the telescope, that '... a true description of the Body of Saturn only, were enough for the Life of one Astronomer'. These were indeed three projects he pursued at Gresham.

In a wider sense also, Wren's work falls within the pattern set in his Greshamite history. Though expressed in terms appropriate to his audience, this was not a statement only for the occasion. If we look over the whole character of his work, it does combine practical mathematics and its development with an approach to natural philosophy informed by the practice of the mathematical sciences – the use of experiment, the use of instruments and the incorporation of mathematics. Not only in his methodology but also in the content of his work, Wren lived up to his Greshamite history: prominent were telescopes, microscopes, magnetism, elliptical astronomy and longitude.

Something close to the account of mathematics and natural philosophy that Wren sketched in his inaugural address and that he positioned in a

Gresham context, does give coherence to his work. It also makes his eventual focus, in the circumstances following the Fire, on a particular branch of practical mathematics involving many of the Greshamite virtues - such as mathematics, practical application, instruments, civic service and public benefit - thoroughly appropriate.

Why translate Serlio?

J.V. Field

In a collection of papers about Gresham College, the present contribution is something of an anomaly. It will largely be concerned with the work of the architect Sebastiano Serlio, who was born in Bologna in 1475 and died in Fontainebleau in 1554, more than forty years before the foundation of the College. Moreover, we shall mainly be considering intellectual developments in Italy. The relevance of this discussion to Gresham College is that Serlio's works, which were written in the vernacular, are a good example of the Italian practical tradition. It was this kind of useful mathematical learning that Sir Thomas Gresham wished to encourage in England. One might claim it as a small indication of his programme's being taken seriously outside the College that Serlio's works first appeared in English translation in 1611. The publisher, Robert Peake, who may also have been the translator, dedicated this edition to Henry, Prince of Wales, with the usual rhetorical flourishes and a statement of his belief that the printing of the book was

... to benefite the Publicke; and convay unto my Countrymen (especially Architects and Artificers of all sorts) these Necessary, Certaine, and most ready Helps of *Geometrie*: The ignorance and want whereof, in times past (in most parts of this Kingdome) hath left us many lame Workes, with shame of many Workmen; which, for the future, the Knowledge and Use of these Instructions shall happily prevent...¹

We may note that it seems to be taken for granted here that what is lacking among native English workmen is specifically identifiable as mathematical learning.

Serlio's writings on architecture have a complicated printing history. The first to appear was Book 4 (Venice, 1537), which deals with the Orders of

¹ [Sebastiano Serlio], *The first Booke of Architecture, made by Sebastian Serly, entreating of Geometrie*. ... (London: Robert Peake, 1611), 'To the High and Mighty Prince Henry, Prince of Wales', p. A2. There is no title page to the complete work, but the five books, which each have individual title pages, seem to have been issued together.

architecture. Next came Book 3 (Venice, 1540), on the architectural monuments of the Ancient World. Books 1 and 2, on geometry and perspective, then appeared together (Paris, 1545). These two were followed by Book 5, on various temples (Paris, 1547). A rather slim volume entitled Book 6, and describing doorways of various designs, appeared in Lyons, apparently without Serlio's consent, in 1551. (There is no corresponding volume in the plan described in the Letter to the Reader that prefaces Book 4.) Book 7, on villas, was published in an edition by Jacopo Strada (c.1513-88) in 1575, and Strada says he also published an eighth book, on fortification, but this is now known only in manuscript.² In 1551 and 1584 collected editions (Books 1 to 6, then 1 to 7) appeared in Venice, and a further edition of the latter collection came out in 1619.

All Serlio's works were written and first published in the vernacular, with occasional eccentricities of spelling applied to his Tuscan by Venetian compositors. However, a Latin edition (of Books 1 to 6) appeared in Venice in 1569, which indicates that the publisher had reason to suppose the books would be of interest to a learned international readership. There were several reprints of the original texts, and partial translations appeared in Dutch (1553, 1606), German (1562, 1608) and French (1545, 1550). The English version of 1611, which its title pages (one for each book) describe as 'Translated out of Italian into Dutch, and out of Dutch into English', seems to have been made from the German text of 1608, which no doubt explains its use of black-letter type. Serlio's own editions were in up-to-date humanistic typefaces.

As this publishing activity indicates, Serlio had a considerable following in his own time and his reputation remained high even after his death. In view of the rapid evolution of architectural style, and fashions of all kinds, in this period, the continuing use of Serlio's books suggests that they were seen as inculcating correct principles. This does indeed seem to have been so. For example, the long full title of Roland Fréart de Chambray's *Parallèle de l'Architecture Antique et de la moderne* (Paris, 1650) includes Serlio among the 'principal authors who have written on the five orders' whom

² The manuscript is in Munich, and has now been published: F. P. Fiore (ed.), *Sebastiano Serlio architettura civile libri sesto, settimo e ottavo nei manoscritti di Monaco e Vienna* [notes by F. P. Fiore, T. Carunchio] (Milan, 1994). For a detailed account of the printing and translation history of Serlio's writings see *Sebastiano Serlio On Architecture; vol. 1: books 1-5 of 'Tutte le Opere d'Architettura e Prospettiva' by Sebastiano Serlio*, translated from the Italian, with an Introduction and Commentary by Vaughan Hart and Peter Hicks (New Haven and London, 1996). See also Sebastiano Serlio, *Serlio on domestic architecture*, text by Myra Nan Rosenfeld, Foreword by Adolf K. Placzek, Introduction by James S. Ackerman (New York, 1996). In what follows, little attention will be paid to differences between editions, since our main concern is with the English text of 1611. In particular, when I needed the vernacular text I used the earliest one available in the British Library.

the book proposes to compare one with another. The sixth chapter of the book is titled 'General estimate of all the authors included in this collection' ('Jugement en general de tous les auteurs rapportez en ce recueil'). First come Andrea Palladio (1508–80) and Vincenzo Scamozzi (1552–1616), to be followed by Serlio and Vignola (Giacomo Barozzi, called da Vignola, 1507–73).³ Precedence is awarded for archaeological exactitude, and the provision of detailed measurements, not for mere chronological priority. Serlio's was in fact the earliest published codification of the 'five orders' of ancient architecture: Tuscan, Doric, Ionic, Corinthian and Composite.⁴ Fréart refines this system by dividing the orders into Greek ones: Doric, Ionic and Corinthian, and Latin ones: Tuscan and Composite.

Fréart's book, which is dedicated to two of his brothers (both holders of public office), is heavily prescriptive in tone, being chiefly concerned with establishing correct systems of proportion in various elements of architecture. The author's tone is indeed so patrician that it suggests that by their disclaimers ye shall know them. The preface (*Avant propos*) at once cites one possible reproach, namely 'That not being an artisan it is not my province to prescribe to others the rules of their craft...'.⁵ Perish the thought! He then suggests that it may not be considered suitable for today's craftsmen to be constrained to follow the rules of the Ancients. Such possible objections are instantly dismissed, together with 'several other similar ill-defined and frivolous arguments' which are not specified.⁶ Fréart's highest praise goes to Palladio, and to Scamozzi, as his pupil. Serlio is criticized for the low quality of his illustrations, and we are told that what is needed is

³ The full title of the volume is *Parallèle de l'Architecture Antiquie et de la moderne, avec un recueil des dix principaux auteurs qui ont écrit des cinq ordres; sçavoir Palladio et Scamozzi, Serlio et Vignola, D. Barbaro et Cataneo, L. B. Alberti et Viola, Bullant et De Lorme, comparez entre eux etc.* (The chapter of explicit comparisons, Chapter 6, begins on p. 20.) Daniele Barbaro (1513–70) was presumably given his initial to distinguish him from his uncle, the famous humanist Ermolao Barbaro (c.1410–71). Leon Battista Alberti (1404–72) seems to have slipped in largely on account of his great fame as an arbiter of style. None of the writers Fréart mentions belongs to his own time. One of the nearest is Giuseppe (or Gioseffo) Viola Zanini, whose short treatise *Dell' architettura* (Padua, 1629) seems to have been published posthumously; the dedicatory letter describes Viola as a Paduan painter and architect, and references in the text suggest he was still alive in the 1590s. Fréart indicates that his own countrymen, Philibert Delorme (c.1515–70) and his successor as architect of the Tuileries, Jean Bullant (1510–78), have been considered separately merely on account of being French rather than Italian.

⁴ The list, with accompanying comparative illustrations of columns and entablatures, appears in the first of his books to be printed, the one about architecture in the new classical style, that is Book 4 (Venice, 1537).

⁵ Fréart de Chambray, *Parallèle de l'Architecture ...*, *Avant propos*: 'Que n'estant point artisan ce n'est pas mon faict de prescrire aux autres les regles de leur mestier...'

⁶ Idem: 'plusieurs autres semblables raisonnemens vagues et frivoles'.

Serlio's learning with Vignola's pictures.⁷ In the realm of archaeology it is obviously recognized that the quality of illustrations is very important. However, Fréart's preferences are a little mysterious. A few of Serlio's illustrations, such as a picture of the Sphinx and an excessively acute-angled pyramid,⁸ are second-hand or apparently partly based on verbal descriptions, but many of them are very good and tend to bear out Serlio's claim to have made drawings from the original monuments. Though it is difficult to judge from the woodcut versions, it seems likely that Serlio was simply a less accomplished draughtsman than Palladio. Fréart may, moreover, be parroting a commonplace in telling us that the practitioner's education must include the study of geometry.⁹ Fréart's own book contains no mathematics beyond the quantities of numbers that appear in specifying proportions. Moreover, the writings of Pietro Cataneo (d. 1569), who Fréart puts in third place, with Daniele Barbaro, are very mathematical – indeed to the historian they are of independent interest for their mathematical content – but this does not earn Cataneo praise from Fréart; Cataneo is apparently included simply as a foil to Barbaro, being described as one who 'will merely be a little clerk in the retinue of that great prelate'.¹⁰

Fréart's readers included John Evelyn (1620–1706), who considered the book so useful that he made a translation of it (published in London in 1664). Evelyn's Preface is much more genial in tone than Fréart's. However, his Epistle Dedicatory does include a counterpart to Fréart's prescription that geometry is required in the education of the artisan, telling his readers that

... our young *Architects* and their *Subdiarles* [should take pains] about the easier *Principles* of *Geometrie*, the *Rudiments* of *Perspective*, and a ready address of well *Designing* ...¹¹

The career of Christopher Wren (1632–1723) suggests that this opinion was probably not controversial in its time and place. Indeed, there is very little evidence that the opinion that mathematics was useful for architecture was ever controversial. This is no doubt because the people who objected that it

⁷ Vignola's text, first published in 1562, is very brief.

⁸ The defective Sphinx and accompanying pyramid (whose shape is too close to that of the pyramid of Cestius in Rome) occur on f. 43v of the 1611 edition of Book 3. Pyramids of this shape continued to be shown as 'Egyptian' during the seventeenth century, for instance in several paintings by Nicolas Poussin (1594–1665).

⁹ Fréart de Chambray, *Parallèle de l'Architecture*..., p. 2, ll. 2ff.

¹⁰ Ibid., '[Cataneo] ne fera qu'un petit clerc à la suite de ce grand Prelat'. Daniele Barbaro is commended for his learned commentaries in his editions of Vitruvius (Venice 1556 and 1566). On Cataneo's writings, see below.

¹¹ Fréart de Chambray, *Architecture*, trans. John Evelyn (London, 1664), 'Epistle Dedicatory' [by Evelyn], p. *b verso.

was much more useful to know how to mix a good mortar (say) did not write books. However, the repeated defences of mathematics in prefaces are evidence of a kind, and Peake is by no means alone among English writers of the late sixteenth and early seventeenth century in saying that his own countrymen are behindhand in mathematical skills. All the same, the ordinary workman is extremely unlikely to have had the money to buy a large illustrated book like the 1611 English version of Serlio. The publication is addressed to the workman's employers or prospective employers, that is persons with an interest in up-to-date styles in architecture. Serlio too had had such readers in mind, and many people must also have valued his books for their record of the monuments of Antiquity, which were to be taken as the pattern for more recent styles.

ANTIQUITY

Serlio's account of ancient architecture is contained in Book 3, published in Venice in 1540. Although the work may appear to be largely of antiquarian interest, it did also have a certain practical significance for architects of Serlio's time. More or less exact copies of ancient buildings were not only required in stage sets but more especially provided models for temporary architectural structures erected for elaborate celebrations, such as princely weddings or the official entry of a potentate into a city.

Serlio discusses monuments by type, and in what he takes to be their chronological order. There is a very detailed account of the Colosseum, complete with cross-sections of the masonry; and we have a full series of triumphal arches, which would have been particularly useful for occasions such as a visit by a pope or emperor. For the arch of Titus, Serlio provides a ground plan (complete with a line to show the true length of half of the Roman foot in terms of which measurements are supplied;¹² on the following page he gives a front view (again with a discussion of dimensions).¹³ The next page shows details such as profiles of mouldings, but Serlio disclaims having any intention of giving a complete description of something so elaborate, though he does note that many triumphal arches have features that run contrary to what is described as correct usage in the writings of Vitruvius.¹⁴ No scales are given for the details, but Serlio says they have been measured and then drawn in the correct proportions. It should be noted that at this date (1540) the publication of drawings done to scale was exceptional. It is not clear that it is meaningful to ask when scale

¹² Serlio, *The thirde Booke, Intreating of all kind of excellent Antiquities* ... (London, 1611), f. 48v.

¹³ *Ibid.*, f. 49r.

¹⁴ *Ibid.*, f. 49v.

drawings began to be used – since it would be awkward to distinguish them from measured drawings in all cases – but these of Serlio are surely among the earliest to appear in print.

Renaissance architects felt close to this ancient architecture, which after all surrounded those of them who worked in Rome, and this feeling is expressed by Serlio's inclusion in his book of some recent buildings designed in the ancient style. The architects whom Serlio singles out for praise in this context are Donato Bramante (1444–1514) 'of Casteldurante in the Dukedom of Urbin' and his follower 'Raphael Durbin, Paynter'. Raphael (1483–1520) did indeed come from Urbino, but his family name was Santi. In addition to occasional comic infelicities such as this, there are passages in which the repeated translation has made Serlio's style more verbose (and sometimes also less clear) than it is in the original. On the whole, Serlio's Tuscan has a workmanlike quality that accords well with the content of his books.

MODERN ARCHITECTURE

A few modern buildings are discussed in Book 3. However, general principles had been considered in Book 4 (Venice, 1537), which first describes the distinctions to be made between the five orders and then proceeds to provide examples of the use of each. These examples are presented simply as designs, rather than records of existing structures. Fig. 7 shows an entrance arch in the Tuscan style, which is confusingly also sometimes called 'Rustic'. Its proportions are none the less defined in a thoroughly Vitruvian manner:

The proportion of this Gate, viz. the opening is twice as high as broad: the Pilaster and the Arch are a fifth part of the breadth of the light: the great Pillar shall be once so broad againe, and the height of three breadths. The height of the Base shall be a fourth part, and the Capitall a third part, and so great the Capitall or impost under the Arch shall bee. The Facie in the place of the Architrave shall be as high as the Capitals: the Facie also as much, and also the Cornice, following the rule aforesayd: the rest may be found with the Compasse.¹⁵

The final words indicate that the drawing is again made to scale, despite the fact that the illustration gives an appearance of depth by a fairly discreet display of convergent orthogonal lines between the stones in the thickness of the arch. We may note also that all the proportions are expressible simply as ratios of small numbers. As we shall see, this is indeed the type of

¹⁵ Serlio, *The fourth Booke. Rules for Masonry, or Building with Stone, made after the five manners or orders of Building ...* (London, 1611), f. 8v.

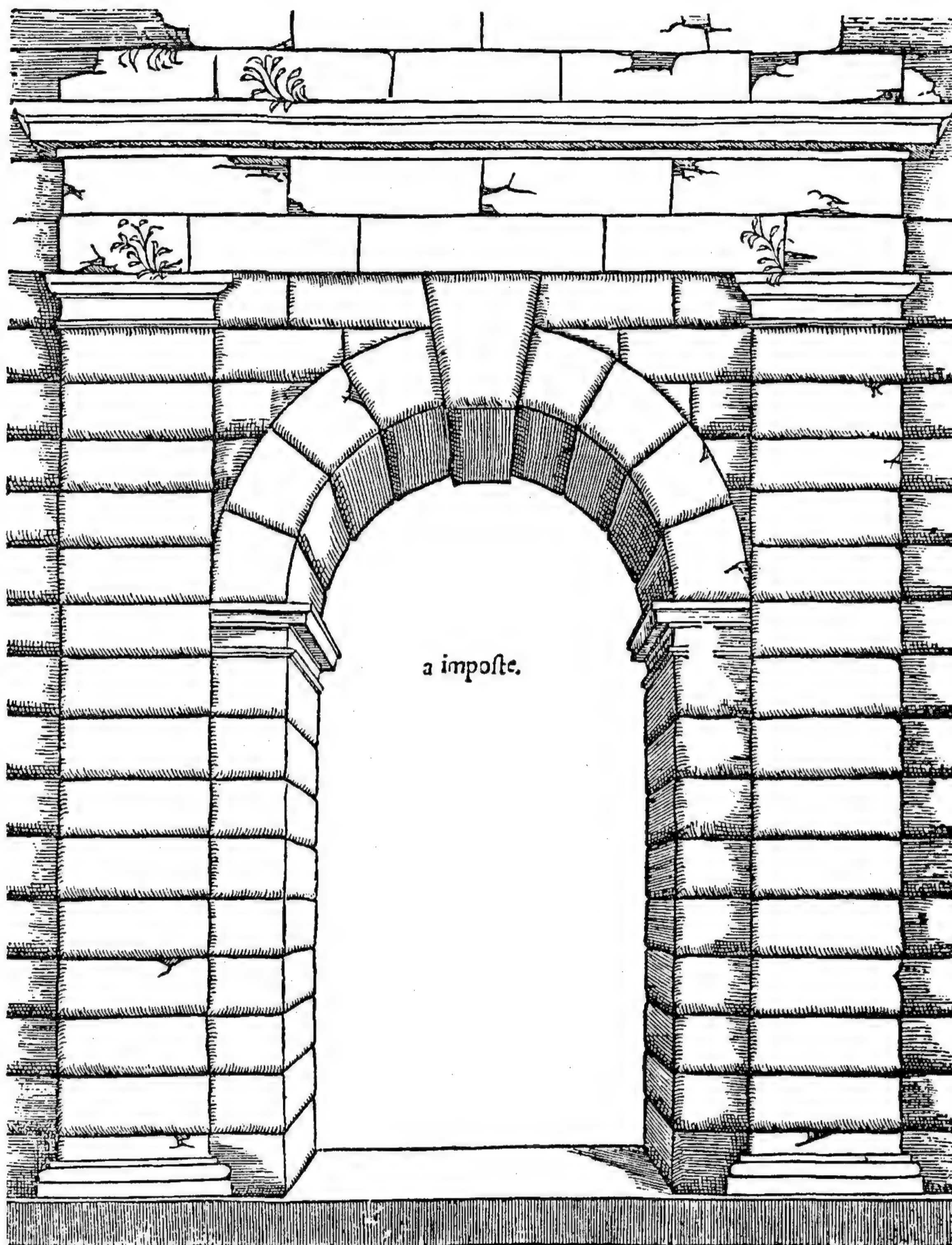


Fig. 7 Gateway in Tuscan or Rustic style, from Serlio, The fourth Booke. Rules for Masonry, or Building with Stone, made after the five manners or orders of Building ... (London, 1611), f. 8v.

proportion that Serlio considers in his mathematical books (Paris, 1545). As was recognized at the time, the use of ratios of small numbers provides a link with the mathematical basis of music, since the ratios of the lengths of strings which give consonant pitches are also expressible in terms of small numbers. In music theory the numbers are usually those of the Pythagorean Tetractys, that is 1 to 4, but a little after Serlio's time an eminent musical theorist, Gioseffo Zarlino (1517–90), suggested an alternative system which used the numbers 1 to 6, which he called the 'senario'.¹⁶ In 1534, both Serlio and a music theorist, Francesco Giorgi (1466–1540), were consulted about revisions to the design of the church of San Francesco della Vigna in Venice, whose architect Jacopo Sansovino (1486–1570) was alleged to have employed unsuitable proportions.¹⁷

The Tuscan gateway shown in Fig. 7 may appear to be a reconstruction of a classical structure, with additional antique touches provided by cracks and plants growing out of some of them. There is, however, no explicit indication that it is ancient, and the majority of Serlio's examples definitely belong to his own time. For instance, the church shown in Fig. 8, whose style epitomizes that of work of the early cinquecento, is given as an example of the use of the Corinthian order. The illustration of the façade is accompanied by a partial plan, showing the flight of steps, the outer wall and the first bay of the nave, including a pair of column bases. Serlio also sets proportions, making the overall width 32 units, the width of each column one unit, and so on. It appears that the illustration is again to scale since we are told that we may measure sizes from the diagram. This does not seem a very practical proposition, since these parts of the illustration are rather small. However, larger versions of similar things are to be found elsewhere in the work, so an enterprising craftsman might have managed somehow.

In fact, later in Book 4 Serlio supplies detailed illustrations of many small features and fittings, such as designs of doors (f. 65r). On the opposite page (f. 64v) we have diagrams to show the design of hinges, contrasting the ancient design with the one that is now in use. There follow designs for ceilings with elaborate coffering, and a number of intricate patterns for gardens. These last chapters may remind us that Serlio moved to France in 1540, where he worked for François I at Fontainebleau and elsewhere. A

¹⁶ See Gioseffo Zarlino, *Istitutioni harmoniche* (Venice, 1558). Zarlino came to Venice in 1541 to study under the then Maestro di Capella at San Marco, Adrian Willaert (c.1490–1562). He became Maestro di Capella at San Marco in 1565.

¹⁷ See R. Wittkower, *Architectural principles in the age of humanism*, (1st edn London, 1949; a large number of reprints). On Serlio's participation in the intellectual life of Venice, see Manfredo Tafuri, *Venezia e il Rinascimento: religione, scienza, architettura* (Turin, 1985), especially pp. 90–112.

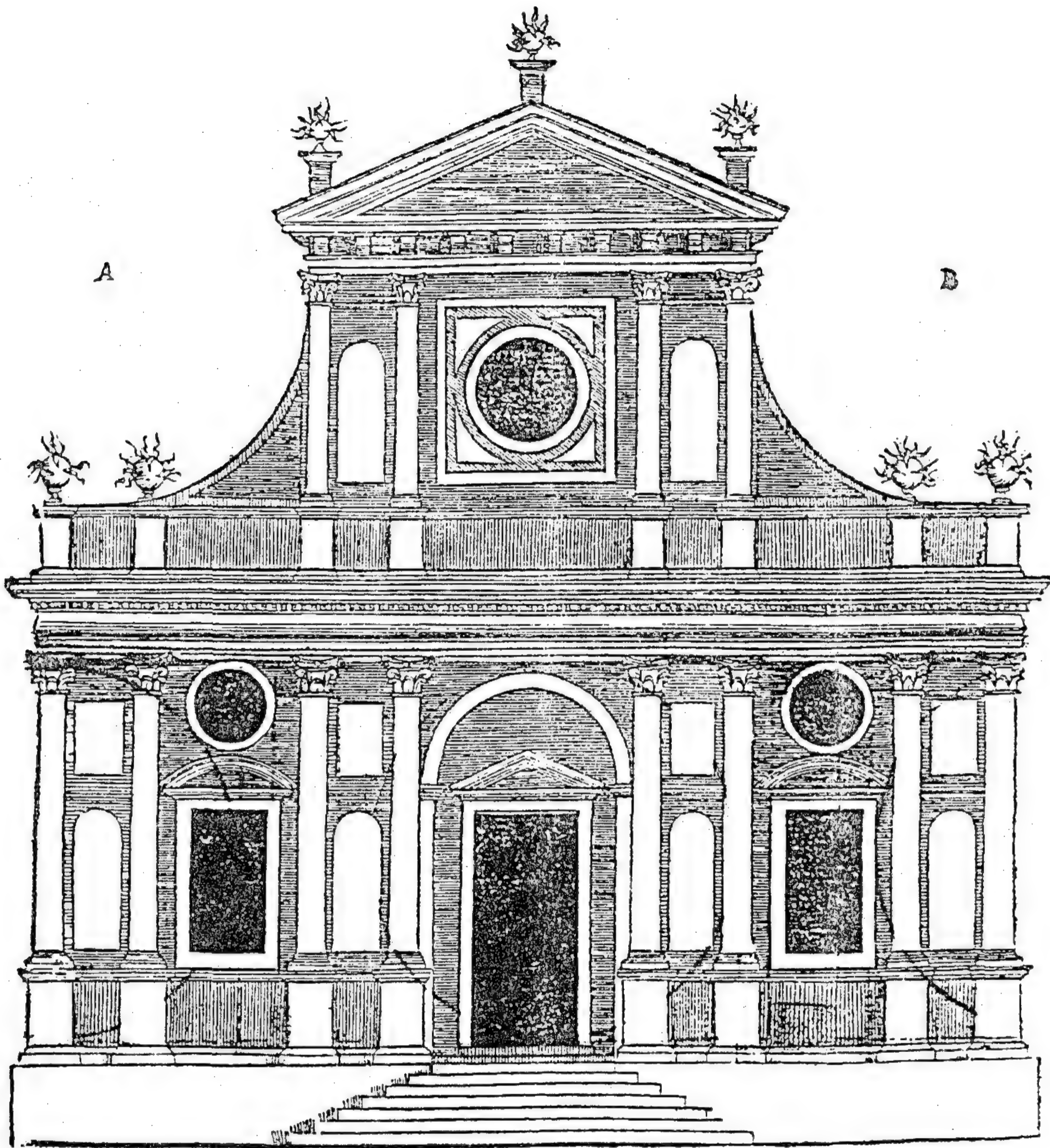


Fig.8 Church using the Corinthian order, from Serlio, The fourth Booke. Rules for Masonry, or Building with Stone, made after the five manners or orders of Building (London, 1611), f.51r.

compendium of Italian Renaissance style had an obvious export value. One buyer (perhaps of the Latin edition of 1569) may have been the Danish astronomer Tycho Brahe (1546-1601) who visited Venice in the mid-1570s (see below).

FORTIFICATION

The temples in Serlio's fifth book (Paris, 1547) have been placed in a logical order according to the shapes of their ground plans. The circular ones are followed by one whose plan is an oval, and when Serlio turns to polygonal plans he includes one that is a regular pentagon. The pentagonal shape is more usually associated with fortifications and seems unlikely to be acceptable for a church. The pentagon's interest for military engineers in the sixteenth century was its supposed practicality in the design of fortifications intended to withstand attack by cannon. A polygonal shape, with bastions protruding at its corners, was intended to make it difficult for the attacker to fire more or less perpendicularly at a wall without at the same time exposing himself and his weaponry to defensive fire from nearby bastions. Various polygonal shapes are discussed in books about fortification, but the regular pentagon is the most popular. It is not an easy shape to draw with ruler and compasses (though a construction is given by Euclid).¹⁸ However, a suitable use of mathematical skill could provide practical methods for drawing the shape on the ground, and the stress on the pentagon in books does seem to reflect actual usage in the field.¹⁹ Serlio did design fortifications for François I, but the standard text on the matter was written by Pietro Cataneo, *Prattiche delle due prime matematiche* (Venice, 1559, second edition 1567). This begins with some serious mathematics, but later is mainly concerned with fortification. It was presumably the work's lack of substantial discussion of architectural style that caused Fréart to dismiss Cataneo as merely a subordinate to Barbaro (see above). In the twentieth century, historians tend to be more generous, and Cataneo is sometimes credited with the invention of the polygonal fort. The popularity of Cataneo's text may partly explain why Serlio's book on fortification was apparently not printed in the Renaissance.

MATHEMATICS

The absence of fortification from the original plan of Serlio's writings on architecture may have affected his choice of topics in the first of the two

¹⁸ Euclid, *Elements* 4, Proposition 11.

¹⁹ One such construction is preserved in a collection of fortification drawings in the State Archives in Venice; see J. V. Field, *The invention of infinity: mathematics and art in the Renaissance* (Oxford, 1997), pp. 129-30, and Fig. 6.16.

mathematical books (Paris, 1545). There is, in fact, a notable lack of polygons compared with what we find in other practical mathematics texts of similar date. The work is interesting, however, in that it provides us with indications of the kind of mathematical learning that Serlio considered useful to craftsmen concerned with the design and construction of buildings. As we shall see, Serlio himself proves to be an early example of what the Italians call a 'learned architect' (*architetto scienzato*).

Serlio begins his first book, 'on Geometrie', by defining such things as a mathematical point, a straight line, a rectangle and so on. Among the first problems is that of drawing a rectangle with the same area as a given triangle (f. 3v). As is usual in mathematics texts in the practical tradition, he deals with several special cases first. The problem is then stated in its general form. In practical works it was usual at this time (1545) to give proofs by giving numerical examples, but here Serlio gives a proof of the result in general geometrical terms. While the style is not exactly that of Euclid, we undoubtedly have something that has affinities with works in the learned tradition which Euclid represents. The proof that is presented has gaps in it, but it is actually correct. It should be noted also that, although this problem may at first seem an entirely abstract one, it does have practical applications in surveying. The area of the rectangle can be found easily (as the product of its width and length) which allows one to find the area of the original triangle. Finding areas was a standard surveying problem because agricultural taxes were usually assessed according to the area under cultivation. This meant that both the collector and the payer of taxes had a vested interest in being able to carry out such calculations.

A little later we have a problem that is explicitly linked to surveying, that of dividing an area into two equal parts in such a way that each may have access to a well.

An Architecte must also undergoe other burthens, for that hee must know how to deuide a piece of ground, that no man may be hindred thereby. As for example, if there were a piece of ground that lay three cornerd wise, with unequall parts, having on the one side thereof a Well, but not in the middle: and this ground, or three cornerd piece of Land is to bee devided into two equal parts, in such sort that each of them may have the use of the Well: it must be done in this manner ...²⁰

The accompanying diagram is shown in Fig. 9. In this version the well, lying on the line BC, has unfortunately not been given its letter, G. The method of solution is as follows. The well is at G on the line BC. Construct the mid point of BC, and call it D. Draw the lines GA and DA. Draw through

²⁰ Serlio, *The first Booke of Architecture, ... entreating of Geometrie* (London, 1611), f. 3v.

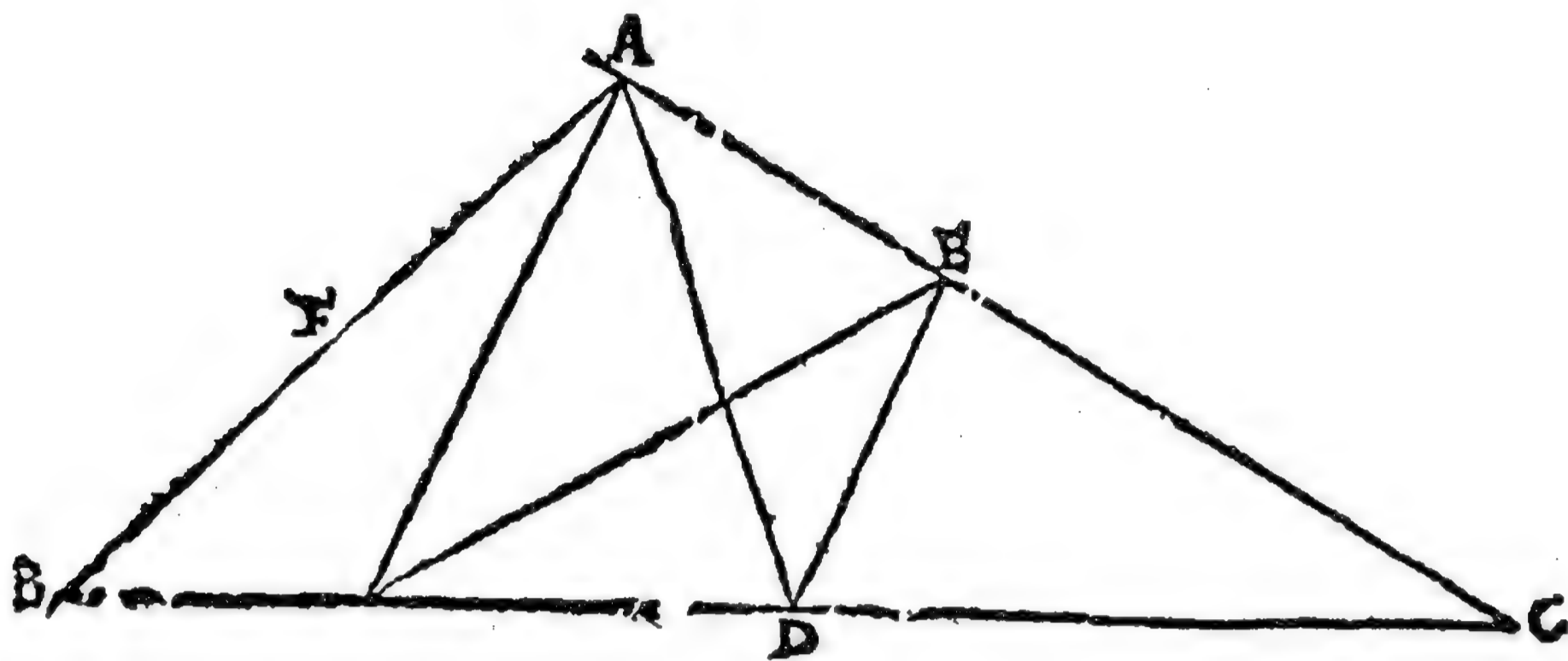


Fig. 9 Diagram for dividing an area ABC into two equal parts such that each has access to a well G (a point on BC, not lettered in diagram), from Serlio, *The first Booke of Architecture, ... entreating of Geometrie* (London, 1611), f. 3v.

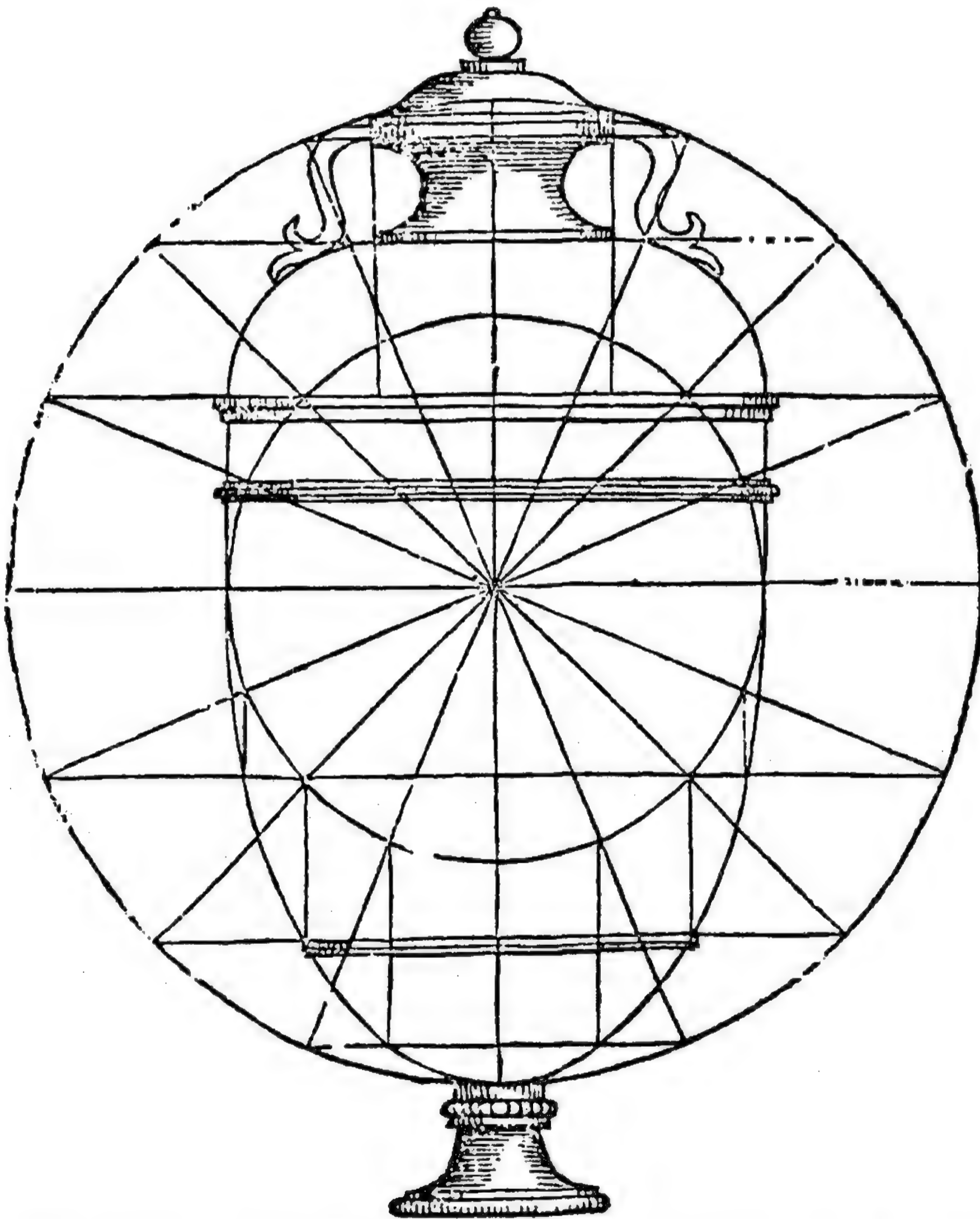


Fig. 10 Diagram for drawing the profile of an ornamental urn, from Serlio, *The first Booke of Architecture, ... entreating of Geometrie* (London, 1611), f. 9r.

Draw a line parallel to GA to cut AC in the point E. Draw line GE, which is the line that divides the triangle in the required manner.

Serlio describes this construction, but he does not supply a proof that it is correct. A proof can be supplied quite easily, as follows. D has been constructed as the mid point of BC, so the area of triangle ADC is half the area of the complete triangle (since the area of a triangle is half its base times its height). As can be seen in the diagram, triangle ADC can be thought of as made up of triangles EDC and ADE, so in terms of areas we have

$$\Delta ADC = \Delta EDC + \Delta ADE$$

But triangle ADE has the same area as triangle EGD, since they have the same base (DE) and lie between the parallel lines DE and GA. (That triangles on the same base and between the same parallels have equal areas is proved in Euclid, *Elements* 1, Proposition 38.). So we can substitute EGD for ADE in the right hand side of our equation, which gives

$$\Delta ADC = \Delta EDC + \Delta EGD$$

As can be seen in the diagram, the sum of triangles EDC and EGD (which is on the right side of this equation) gives us the triangle EGC, one of the two parts into which the triangle ABC has been divided by drawing the line GE. Our equation shows that this is equal to the area of triangle ADC, which as we have seen is half the total area of triangle ABC. So the line GE bisects the area of triangle ABC as required.

This proof, which in its essentials is very simple, has been given with full Euclidean rigour for two reasons. The first is that when Serlio described his construction he actually gave an unnecessary instruction, namely to draw AD. We do not in fact use the line AD in finding the line GE. But we do use AD in giving a proof that GE is the line required. So that Serlio put in AD suggests that he may have had the proof in mind. This points up one of the standard difficulties in understanding what is going on in elementary or instructional works. One can never assume the writer is telling the readers all he knows, since his purpose is rather to tell them what he thinks they need to know.

The second reason for giving the proof in full is that the problem itself is one that is well known in the learned mathematical tradition. It is certainly Greek in origin, but problems of dividing areas mainly survive in Islamic sources. For example, this very problem, and several others like it, appear in a Latin treatise *De superficierum divisionibus*, ascribed to 'Machometus Bagdadinus', a manuscript of which came into the possession of John Dee (1527-1608) who, when visiting Urbino in 1563, gave it to Federigo

Commandino (1509–75), who published it in 1570.²¹ Although Islamic works had been very important in forming the practical tradition of mathematics, scholarly interest in more advanced Arabic texts becomes relatively common only in the seventeenth century.

The problems described so far may seem rather on the theoretical side, though they do have a practical usefulness also. Some of Serlio's problems are much more down to earth. For instance, a few pages later he considers how to draw the profile of an ornamental urn. This may not seem in itself to be an urgent construction problem, but such things were essential decorative elements and architects were of course expected to provide them. The workman would need to be supplied with a template of the profile to ensure that all the urns were the same. Serlio is not concerned with the actual making of the urn, which was presumably done by turning in a lathe, but only with the drawing for the template. Fig. 10 (on p. 209) shows the diagram that he supplies for the first shape of urn, for which we are given the height (excluding the foot), shown by the larger circle, and the width, shown by the smaller circle. Serlio gives very little explanation, merely saying that 'the skilfull workman' will be able to judge from the diagram, and adding that the neck and foot are left to his discretion. Above the horizontal diameter, one can see that the points in which the evenly-spaced diameters cut the smaller circle have been used, say, to establish the positions of the two horizontal mouldings. Below the horizontal diameter the rule is simple. Radii are drawn, and from the points in which they cut the inner circle perpendiculars are dropped to the horizontal line joining the points in which they cut the outer circle.

Serlio has in fact used the same method of construction in the two previous problems, in which one had to draw a curve lying between two semicircles, that is, its height was given by one semicircle and its width by another. The interest of the matter is that the curve that Serlio is constructing, point by point – so that the 'skilfull workman' will eventually have to join up the points with a smooth curve – is an ellipse. A number of Renaissance bridges are known to have approximately semi-elliptical profiles to their arches. What we see here is one way in which they may have been drawn. It is clear that no particular significance is attached to the mathematical properties of the curve, which has arisen merely as a smooth shape running between the two circles defining the width and height of the arch. Serlio does not give the curve its name, though it is well known in the learned tradition as one of those that are obtained by taking sections through a cone. It is of course possible that Serlio did not recognise this

²¹ See the paper by Stephen Clucas in this volume, pp. 146–73. The work was published in English translation in 1661.

curve as being the same as the one learned mathematicians knew as an ellipse, but as we shall see, there is a small indication that he did.

Comparison between Serlio's original text and those of some of the translations is instructive in regard to the levels of mathematical understanding of such things. In the Venice 1551 edition, the paragraph before the diagram of the curve between the two semicircles ends

... così da l'un punto al altro del le linee perpendicolari sia tirata una linea curva, la quale non si puo fare col compasso, ma con la discreta, & pratica mano sara tirata, lo essempro di questa, si vede qui sotto.²²

This is not particularly complicated; I take it to mean

... thus from one point to another on the perpendiculars let a curved line be drawn, which cannot be done with compasses, but it can be drawn by a careful and practised hand, and what it will look like can be seen here below.

The English version of 1611 curtails this passage, ending the paragraph 'as by the points or prickes hereunder is shewed'.²³ Checking back through the editions shows that the removal of the reference to the impossibility of drawing the curve with compasses is apparently due to Pieter Coecke (1502–50), whose translations (into German) have been faithfully followed by whoever made the English version of 1611. As we shall see, a few pages later Serlio shows the reader how to draw curves that look fairly like an ellipse but which can be drawn with compasses. Taken in conjunction with these instructions, his remarking upon the fact that the earlier curve cannot be drawn with compasses suggests that he may indeed have realized it was an ellipse. The curves drawn with compasses are what we should now call ovals, but the term – which of course literally means 'egg-shaped' – was also used for the ellipse in the sixteenth century.

It seems likely that Coecke omitted Serlio's comment because he did not understand it. In this he was more prudent than Carolus Saracenus, the translator who made the Latin version of 1569. His Latin text ends the paragraph with

... & ab uno puncto ad alterum punctum perpendicularium, novissimaque harum linearum linea curva perpetuè extendatur, quae doctæ potius expertaèque manus usum quam circini ipsius operam efflagitabit: cuius quidem rei esse tibi subjectum appositumque exemplar.²⁴

This seems to me to say

²² Serlio, *Architettura* (Venice 1551), Book 1, f. 10v.

²³ Serlio, *The first Booke of Architecture, ... entreating of Geometrie* (London, 1611), f. 8v.

²⁴ Serlio, *De architectura* (Venice, 1569), Book 1, p. 15.

... and from one point to another of the perpendiculars, let there be drawn another new continuous curved line, which will be done more readily (*pottius*) by an expert hand than by the use of the compasses: you can see the result in the accompanying figure.

That is, Saracenus seems to have misunderstood, and to be under the impression that it is merely better to draw the curve freehand.

Drawing curves freehand was of course a realistic proposition for professionals, and Saracenus is certainly correct in his estimate that Serlio is addressing such people, at least in the sense that though patrons might read the books it would be craftsmen who would have to carry out the instructions he provides. In this Serlio's books are like the ostensibly practical treatise of Daniele Barbaro, *La pratica della Perspettiva* (Venice, 1568, 1569). It too tells the prospective patron things he might wish to know, some of them for interest, but some of them also to allow him to keep an intelligent eye on his workmen, or to allow him to ask them to carry out a new task for which they would require relatively detailed instructions. This kind of readership would no doubt have been glad to be given the six alternative designs for urns which Serlio supplies.

Serlio does, moreover, think it useful to teach his readers the correct names for the proportions that he mentions in the course of his work. We are given a square which is then extended to make a rectangle whose sides are in the required ratio. The names of the ratios are the standard ones used in learned mathematics in Serlio's time. They had been in use since Late Antiquity, and were still current in 1611. Each of these standard proportions is expressible as a ratio of whole numbers. The 'sesquiquadrate' rectangle has sides in the ratio 5:4, the 'sesquitertia' has a ratio 4:3, the 'sesquialtera' has 3:2, the 'superbipartiens tertia' has 5:3, and the 'dupla' has 2:1. The 'diagonal' ratio is established by using the diagonal of the original square as the longer side of the rectangle. Applying Pythagoras' Theorem (Euclid, *Elements* 1, 47) to the square shows that its diagonal will be the square root of the sum of two squares on its side, that is the proportion is expressible as $\sqrt{2}$:1.

As we have already seen, Serlio tends to give proportions that are expressible in terms of small numbers. As far as I can tell, the ones he mentions here in his first book do indeed cover all the cases he discusses elsewhere. We may note that the 'rational' proportions, that is those which are expressible as a ratio of whole numbers,²⁵ all use numbers that lie within the range 1 to 6 prescribed by Zarlino's music theory, though they would not be in accordance with the older 'Pythagorean' system, which ruled out the use of

²⁵ The use of the term 'rational' in this sense is standard in mathematics, in the Renaissance and today. It goes back to Latin renderings of Euclid's term, which might more literally be rendered as 'expressible'.

5 and 6. Zarlino's reasons for ruling in 5 and 6 were to do with musical practice, not architecture, but the coincidence is convenient. The diagonal proportion is used much less often by Serlio than the rational ones. Its most notable appearance is to define the shape of the vertical sides of the 'pedestal, or stilobate' of a Doric column, as described in Book 4, Chapter 6.²⁶ The diagonal proportion cannot be expressed exactly since $\sqrt{2}$ is an endless decimal (to ten significant figures it is 1.414213562).

Arguments from silence are notoriously dangerous, but it nevertheless seems worth mentioning that Serlio does not, as far as I can see, either use the proportion now commonly known as the Golden Section (a name dating from the nineteenth century) or even take any account of the possibility of its use. The defining property of the Golden Section, which Euclid calls 'extreme and mean proportion', and Renaissance writers sometimes call 'divine proportion', is that if a line is divided in this way then the proportion of the smaller part to the greater is the same as that of the greater part to the whole. Mathematicians now usually write the resulting proportion as t , the Greek letter τ being the initial of the word for cut, *tomb*, and the cut being made t along a line of length 1. Finding a numerical value for t involves solving a quadratic equation. We get $t = (\sqrt{5} - 1)/2$, which works out as about 0.6180339887... (an endless decimal). This cannot be expressed as a ratio of integers, that is, it is what mathematicians call 'irrational' (the contrary of 'rational'). The proportion can be constructed geometrically using straightedge and compasses. In fact, a construction is given in Euclid's *Elements*, in connection with the construction of a regular pentagon. So there can be no doubt that Serlio knew about extreme and mean proportion. He simply does not propose to use it in his architecture.²⁷

Immediately following the proportions we have a diagram to show how to build a secure ceiling when one has not got any piece of wood long enough to stretch across the complete width or length of the space concerned. The presentation of this is very brisk, consisting simply of a reference to the diagram. This offhandedness suggests the problem itself is regarded as a standard one (realistic or artificial), or at least that knowing how to solve it was a standard piece of showing off. All the same, in the case of the Sheldonian Theatre (Oxford, 1664-69), solving this problem of constructing a ceiling was regarded by his contemporaries as a convincing

²⁶ See Serlio, *The fourth Booke. Rules for Masonry, or Building with Stone, made after the five manners or orders of Building ...* (London, 1611), f. 17r.

²⁷ The otherwise very helpful English edition of Serlio cited in note 2 above unfortunately takes diagonal proportion, in which the sides of the rectangle are in a ratio of about 1: 1.4, to be the same as the proportion defined by the Golden Section, in which the ratio of the sides of the rectangle would be about 1: 1.6. It seems very unlikely indeed that Serlio himself could have equated the two proportions, since he must have known from Euclid that constructing extreme and mean proportion was much more difficult than finding the diagonal of a square.

display of Wren's expertise. This may indicate that the problem was otherwise regarded as essentially artificial. It should, moreover, be noted that, since Wren intended his ceiling to stay up, he had to do some calculations to ensure the beams used were of suitable strength. There is little trace of this kind of practical consideration in Serlio's account of the problem.²⁸

The last problem of Book 1 is that of constructing a doorway. There is a series of lines that set up correspondences between various elements in the design. The construction has been designed so that it could actually be carried out at full scale, or even *in situ*, with string. Furthermore, we may note that since it only involves straight lines and their intersections it could also be carried out to find the outline of a door on a building seen in perspective as part of a stage set. This practical aspect of the construction is relevant because one might otherwise be tempted to regard it as an unnecessarily elaborate way of constructing an opening in the form of a rectangle whose sides are in the ratio 2:1. In fact, as he remarks, Serlio's construction has also been designed to make the opening in the correct proportion with regard to the surrounding square, and the dimensions are such that if the edge of the square is three units, the width of the door will be one unit and its height two units. The proportions of this opening are the same as those of the Tuscan doorway (Fig. 7) and seem to have been more or less standard. The diagram is so plentifully supplied with similar triangles that it may safely be left as an exercise to the reader to find a proof of the result. (Renaissance mathematicians are fond of proving things by means of similar triangles.)

MATHEMATICS OF PERSPECTIVE AND STAGE SETS

When Serlio's second book, on perspective, was first published, in 1545, the subject matter was not as well known as it rapidly became thereafter. In the following fifty years any number of perspective treatises were written.²⁹ Most of these are of very little interest as mathematics, and Serlio's contribution is no exception to this rule. What was important about it was its discussion of stage design. For instance, a copy of the 1619 collected edition of Serlio's works, now in the British Library, was owned by the architects Inigo Jones (1573-1652) and John Webb (1611-72). Their architectural styles indicate a distinct preference for Palladio rather than Serlio, but both of them did extensive work as stage designers.

²⁸ Between the time of Serlio and that of Wren there is a crucial contribution by Galileo Galilei (1564-1642), who made the first attempt at mathematical analysis of the strength of materials in his *Discorsi e dimostrazioni matematiche intorno a due nuove scienze* (Leiden, 1638). See also J. A. Bennett, *The mathematical science of Christopher Wren* (Cambridge, 1982); and the same author's article in this volume, pp. 189-97.

²⁹ The history of Renaissance perspective treatises, their mathematical content and its relation to artists' practice is discussed in Field, *The invention of infinity*.

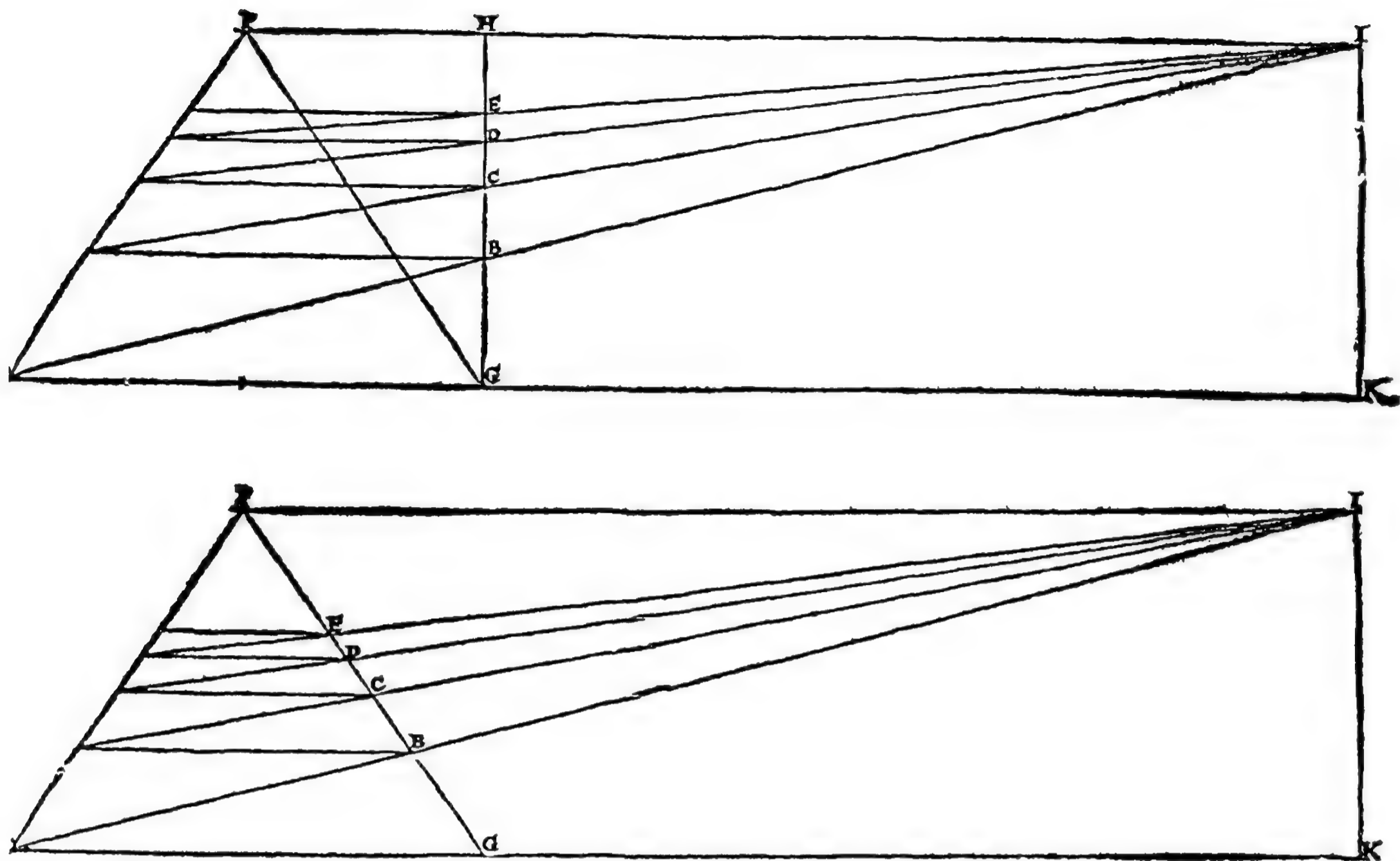


Fig. 11

Fig. 11 Two perspective constructions for finding the images of squares, from Serlio, The second Booke of Architecture, ... entreating of Perspective (London, 1611), f. 1r. The upper diagram shows an incorrect construction that Serlio probably learned from Peruzzi. The lower one shows the distance point method.

Serlio's justification for including a discussion of perspective in a work devoted to architecture is first, inevitably, that perspective, under the name of 'scenography', is mentioned by Vitruvius.³⁰ Arguments about what Vitruvius meant by his references to stage sets have gone to and fro, but current scholarly opinion generally endorses the Renaissance belief that the Romans, and the Greeks before them, did make stage scenery in which a mathematical construction was used to give an illusion of depth. Serlio also gives a second justification for considering perspective, namely that many of the best architects were trained as painters and came to architecture through studying perspective. Among others, he cites Baldassare Peruzzi of Siena (1481-1536), Bramante and Raphael. Peruzzi was Serlio's teacher, and Bramante's assistant in work on St Peter's, but he is best known for the Villa Farnesina (1509-11), whose internal decorations include a room painted by Peruzzi himself showing illusionistic vistas out through imaginary loggias.

Serlio's treatment of perspective makes a show of beginning at the beginning, but is not very clear even in the original. As one would expect, multiple translation does not improve matters, and any reader of the English would almost certainly find it wise to rely heavily upon the diagrams. The first two are shown in Fig. 11. Both diagrams show the problem of constructing perspective images of a series of squares placed one behind the other, the nearest one touching the picture plane (which is assumed to be vertical). The position of the eye is indicated by the point called 'I'. In the set-up considered in the first diagram, the distance of the eye from the picture plane is given by the length IH. The construction for the first square, that is the one shown at the bottom in the diagram, is the construction described by Leon Battista Alberti.³¹ It is mathematically correct. The remainder of Serlio's figure seems to be a nonsense. As far as I can see, there is no adjustment to viewing distance or anything else that will make it mathematically correct. On the other hand, there seems to be no mystery about its immediate historical origin; in his brief history of perspective treatises in the Preface to his edition of Vignola's treatise, Egnazio Danti (1536-86) says Serlio learned it from Peruzzi, and since Danti came from a family of practising artists, he was in all likelihood thoroughly well informed on this matter.³² We may note, moreover, that he does not cast doubt on the

³⁰ *De architectura*, Book 7, Preface, §11.

³¹ *De pictura*, Book 1, §19, 20. A brief account of Alberti's mathematics is given in J. V. Field, 'Alberti, the abacus, and Piero della Francesca's proof of perspective', *Renaissance Studies* 11/2 (1997), 61-88.

³² Vignola (ed. with commentaries) E. Danti, *Le Due regole della prospettiva pratica* (Rome, 1583), Preface (by Danti). Danti's history of perspective is discussed in some detail in J. V. Field, 'Giovanni Battista Benedetti on the mathematics of linear perspective', *Journal of the Warburg and Courtauld Institutes* 48 (1985), pp. 71-99.

correctness of the construction. This is a sharp reminder that perspective is one branch of mathematical science in which everything still works wonderfully well when the mathematics is technically incorrect.³³ So Peruzzi's method had been seen to work in the Farnesina, and Danti is casting no doubts upon it. Serlio, an artist rather than a professional mathematician like Danti, must thus be forgiven for apparently supposing the method is correct. He is of course right in supposing it to be useful. It seems likely that most sixteenth-century artists regarded perspective constructions as a box of tricks, supplying some extra tools in the making of pictures.³⁴

The construction shown in the second of Serlio's diagrams (Fig. 11) is the distance point method. The 'distance point', that is the point representing the position of the eye, is point I, and its distance from the picture plane is given by AI. Diagonals of the images of squares with one edge parallel to the picture plane will all pass through the point I. This diagram is correct, that is the construction shown will give a perspective image that is mathematically correct.

Most of what follows omits the point representing the eye, so one cannot be sure which of the two constructions has been used (and if there is only one square the first construction is correct anyway). Apart from the solecism of its being uncertain whether the basic trapezium shapes of the images of the squares have been constructed correctly, Serlio's treatise, like all other sixteenth-century treatises on perspective, bears a strong resemblance to the perspective treatise written by Piero della Francesca (c.1412-92). That is, the worked examples that form the major part of the exposition are all very close to those considered by Piero.³⁵ Art had changed in many ways since the mid-fifteenth century, but a check on the elements used to convey depth confirms that in this respect painters' problems had changed very little. Architectural settings, dominated by straight lines, continued to provide the main spatial framework. On the whole, paintings such as altar-pieces made less use of such frameworks in Serlio's time than they had in Piero's; later on, surrounding architecture is sometimes reduced to a backdrop or no more than a flight of steps. However, the neat architectural vistas that feature in fifteenth-century paintings reappear, though with some stylistic modifications, in sixteenth-century stage sets. Modifications are usually

³³ The twentieth-century explanation of this phenomenon is that the human eye is extremely tolerant. A few very simple clues suffice to produce an illusion of depth.

³⁴ What happened when people started asking questions is discussed in Field, *The invention of infinity*, especially ch. 7, 'The professionals move in'.

³⁵ A short account of Piero's perspective treatise is given in J. V. Field, 'A mathematician's art', in M.A. Lavin (ed.), *Piero della Francesca and his legacy*, Studies in the History of Art 48, Center for Advanced Study in the Visual Arts, Symposium Papers XXVIII (Washington, DC, 1995), pp. 177-97. A much fuller one will appear in J. V. Field, *Piero della Francesca: a mathematician's art* (forthcoming).

in the direction of archaeological correctness; they do not affect the perspective construction. So Serlio constructs perspective images first of a square-tiled pavement, then of more complicated patterns of tiles, and of some shapes that can be used as plans for buildings, and so on. Then we erect prisms on some of these plane figures as ground plans – this procedure corresponds to the problems in the second book of Piero's treatise – and gradually work our way into fairly complicated architectural vistas. Serlio's instructions for making these drawings are too sketchy for the beginner.

The text of the section dealing with stage design is equally sketchy, but is accompanied by detailed drawings, including sections. In fact, Serlio's designs of the three Vitruvian stage sets, for Comedy, Tragedy and Pastoral, achieved considerable authority, receiving the accolade of being taken over by Daniele Barbaro in his account of stage scenery in his *Prattica della Perspettiva* (Venice 1568, 1569) which, as he tells us in his preface, deals with a number of matters that could not be accommodated in his annotations to Vitruvius.³⁶

THE USEFULNESS OF SERLIO'S WRITINGS

Fréart apparently sees Serlio's writings on architecture as having been eclipsed by those of Palladio. By 1650 this may indeed have been so, at least in serious antiquarian circles. The scope of Palladio's *Quattro libri di Architettura* (Venice, 1570) is more narrowly architectural than that of Serlio's books. Palladio gives careful, and fully illustrated, descriptions of ancient Roman buildings, and equally careful accounts of buildings designed by himself. His own buildings show a style that is classical in a much more archaeologically correct way than Serlio's. There is no counterpart to the church that is Corinthian chiefly in using Corinthian columns (see Fig. 8). In fact, we know that all architects, including Palladio, had considerable difficulties in arriving at a solution to the problem of designing an adequately classical church; as Serlio had remarked (see above), ancient temples were not on the same kind of plan as a church.³⁷ All the same, as far as actual archaeology goes, that is as a record of ancient buildings, Serlio's third book was highly satisfactory, and many people no doubt bought it for exactly that reason. Moreover, the account of the application of the orders in modern buildings, in Serlio's fourth book, was probably useful for a reason that would not commend it to Fréart, namely its tolerant willingness to incorporate classical elements into an essentially vernacular established

³⁶ Barbaro's editions of Vitruvius (Venice 1556 and 1566) contain illustrations of a Vitruvian theatre, often asserted to be based on drawings by Palladio, but no depiction of stage scenery.

³⁷ See Wittkower, *Architectural principles*.

style. Local builders would probably be highly reluctant to adopt a totally new style, and it might in any case seem too bizarre to be admirable. One of the many well-documented classicized vernacular compromises that seem to be derived from Serlio's writings is the main building of Uraniborg, the observatory that Tycho Brahe had built for himself in the late 1570s on the island of Hveen in Copenhagen Sound. Nothing now remains on the site except the marks of foundations, but the buildings, and the astronomical instruments, are described in considerable detail in Tycho's *Astronomiæ instauratæ mechanica*.³⁸ The book is lavishly illustrated. At first glance, the architecture looks like Northern European secular Flemish-influenced gothic (of the palatial kind), but a closer inspection, prompted by the references to classical orders and columns in Tycho's text, reveals Italianate elements very much in the style of Serlio. Moreover, the style of the illustrations is also like Serlio, with a series of neat cutaways accompanied by plans. Tycho had visited Venice in the mid-1570s, so it would have been very easy for him to have bought a copy of, say, the Latin Serlio of 1569.³⁹ The style of classicism of Tycho's palace is also to be found in the even more impressive palace that Albrecht Wallenstein (1583-1632) built for himself in Prague in the 1620s.

The wide diffusion of Serlio's writings, attested by the repeated editions, is no doubt partly inspired by a wish to keep up with Italian fashion. In any case, Serlio's work is essentially practical rather than theoretical, and the mathematics is an integral part of it. As we have seen, there is a close connection between the mathematical techniques that would be required to make real buildings like those shown by Serlio and the mathematical techniques that are put on show in his worked examples. The acceptance of Serlio's work goes with an acceptance that a good architect required mathematical skills. Serlio was, of course, notably learned in other ways also, particularly in his careful study of Vitruvius, and (as we have seen) a certain amount of reading between the lines suggests very strongly that his mathematical skills were more extensive than is immediately indicated by the examples in his text. Serlio gets his style of exposition by means of series of worked examples, from a well-established tradition of 'practical' mathematics, though he deviates from the usual textbook manner in proposing examples in general rather than numerical

³⁸ This was first printed at his own press, at Wandsbeck, in 1598 in a small edition destined for distribution to prospective patrons, but it was reissued in a slightly less luxurious form (though using the same plates) in Nuremberg in 1602. Photographic reprint ('facsimile') Brussels, 1966.

³⁹ It is unfortunate that the most recent biography of Tycho (V. E. Thoren, *The Lord of Uraniborg: a biography of Tycho Brahe* (Cambridge, 1990)), apparently following an American usage, describes this classicizing style as 'Palladian' rather than simply as 'Italianate'.

form. We are seeing a certain coming together of the practical and the learned traditions.⁴⁰

Humanistic panegyrics on the usefulness of mathematics are common enough by the early seventeenth century. In English an early learned example is provided by John Dee's famous preface to Henry Billingsley's English translation of Euclid's *Elements* (London, 1570). In contrast, Serlio belongs to a tradition in which Euclid has long ago been absorbed and shorter panegyrics are followed by serious quantities of actual mathematics. Serlio and his ilk do not just *say* mathematics is useful; they give every sign of actually believing it. Serlio's being translated into English is an indication that some Englishmen were at least showing signs of following suit. And the tendency was to persist. In 1657 the first two books of the 1611 edition of Serlio's work were reprinted (with a few omissions), that is, it was the mathematics not the architecture that was deemed to be of interest. The publisher's puff, on the title page, has a good dash of rhetoric, but is also prepared to be fairly specific. We are told that the work is

A book of Perspective & Geometry, being the ABC, and first degree of all good Art: A New Naturalized Work of a Learned Stranger or An Exquisite Tutor powerfull to benefit the Publick, and convey unto *English* men, especially Architectes and Artificers of all sorts. That is Masons, Carpenters, Joyners, Glaziers, Bricklayers, Plaisterers, Painters and all that live by Hammer and Hand. Necessary, Certaine, and most ready Helps of Geometrie, which is the first degree of all good Art.

The spread of mathematical education which accompanied the recognition of the usefulness of such learning, late though it was in England in comparison with other parts of Europe, had serious implications for the development of natural philosophy. That, however, is part of another story.

⁴⁰ The same tendency, with the additional learning of a later generation, is seen in Scamozzi's *L'Idea dell'Architettura* (Venice, 1615), translated into English as *The Mirrour of Architecture* (1669, and three reprints up to 1700).

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Index

- Accaiuoli, Donato, 119
 Agas, Ralph, 2-3
 Agricola, 92
 'many words' rhetoric of, 94
 Agrippa, Cornelius, 113, 120, 158
 Al-Baghdadi, *see* Bagedinus
 Albategnius, 168n123
 Alberti, Leon Battista, 200n3, 217
 Albinus, 114
 Alcinous, 113-14, 138
 Didaskalikos, 114, 121-2
 Aldus Manutius, 115n35
 Alexander of Aphrodisias, 113
 Al-Kindi, 168n123
 Allen, Thomas, 144
 Anderson, John, Rede Professor of Logic
 at Cambridge, 109
 Anglo-Netherlands exchanges, 15-16
 Anne, Queen, statue of, for Royal
 Exchange, 86
 Antwerp, xiv, 7, 14-15, 18, 20, 34, 70, 78,
 82
 financiers of, 21
 house in Lange Nieustrate, 20, 22-3
 iconoclasm in, 79
 Nieuwe Buers of, 78
 Antwerp-Frankfurt finance market, 22-3
 Anyan, Thomas, 115n36, 121
 Apollonius, *Conics* of, 126
 Aposklides, Aresinius, 115n35
 Apuleius, 112-14, 115n35, 118
 Archimedes, 135, 139, 162
 works of, 126, 128-30, 136
 Aristarchus, 137
 Aristippus, 130-32
 Aristotelianism, 106-7, 109, 112-14, 117,
 120, 122
 Aristotle, xviii, 108-9, 113-14, 116-20,
 123, 140, 157
 Organon, 117
 Rhetoric, 120
 Ascham, Roger, 112
 Ashwell, Hertfordshire, parish church of, 1
 Asola, Francesco d', 115n35
 Athens, 135
 Aubrey, John, 126, 179
 Ayliffe, John, surgeon, 48
 B., I., *The Rich Cabinet...* 97
 Bacon
 Edward, brother of Nathaniel, 57n99
 Francis, xiv, 97-9, 102, 135, 193
 Nathaniel, son of Sir Nicholas, 19, 34,
 37, 56
 Sir Nicholas, Lord Keeper of the great
 seal, 19, 34, 46n39, 56
 Badius, Josse, 107n4
 Bagedinus, Muhammad, *De*
 superficierum divisionibus, 168,
 169 fig. 6, 210-11
 Bainbridge, John, Savilian Professor of
 Astronomy, 177
 Balbi, Pietro, 115n35
 Ball, William, 191
 Barbaro,
 Daniele, 200n3, 201, 207; *La prattica*
 della Perspettiva, 213, 219
 Ermolao, 200n3
 Barbon, Nicholas, builder, 74
 Barlow, William, 177
 Barozzi, Francesco, *Quaestio de*
 certitudine, 153
 Barrow, Isaac, Gresham Professor of
 Geometry, 122n58
 Basel, University of, 120
 Bedwell, William, 178
 Bergh, Christopher de, 178
 Berney, Robert, factor to Sir Thomas, 16
 Bernini, Gianlorenzo, 84
 Bessarion, Cardinal, library of, 111
 Bèze, Theodore (Beza), 117
 Bilborough, associate of T. Crosse, 60

- Billingsley, Henry, translation of Euclid's
Elements (1570), 154–6, 162, 221
- Bindlosse, William, 18
- Blundeville, Thomas, *Three Morall
Treatises*, 91, 93
- Boethius, 118
- Bond, Henry 179, 194
- Bonde, William, 35–6
- Booth, Roger, scrivener, 60n112
- Bostock, Charles, scrivener, 60n114
- Boswell, Sir William, 178
- bottomry (marine insurance), 69, 70–71
- Bowles, Thomas, print-seller, 68
satirical playing-cards of, 68–9, 76,
plates 2–4
- Boyle, Robert, xviii, xxi, 124, 190–91
- Bradshaw, Thomas, apprentice to Sir
Thomas, 18
- Bradwardine's law, 165
- Brahe, Tycho, 206, 220
Astronomice instauratæ mechanica,
220
- Braithwait, Thomas, *The English
Gentleman*, 98–101
- Bramante, Donato, 203, 217
- Breda, 83
- Brent, Sir Nathaniel, 185n28
- Brerewood, Edward, Gresham Professor
of Astronomy, 4, 178, 195
- Briggs, Henry, Gresham Professor of
Geometry, xix, 4, 178–81
Arithmetica logarithmica, 182
editor of 1620 Euclid, 180
Gresham lectures of, xix, 182
involvement in utilitarian matters,
180
Savilian Professor of Geometry, 181
- Brouncker, William, 191
- Bruni, Leonardo, 107n3
- Bryskett, Ludwig, *Discourse of Civil Life*,
95, 98–100
- Bucer, Martin, 109
- Bull, John, Gresham Professor of Music,
xiv, 4
- Bullant, Jean, 200n3
- Bullimore, John, sculptor, 84
- Bulwer, John, *Chirologia*, 91
- Burbage, William, 3
- Burghley, Lord, 59
- Bushnell, John, sculptor, 84–5
- Byrd, William, 36
- Cabasilas, 129
- Cade, Deputy, 9
- Caesarius, Johnannes, 114
- Caius, Dr John, xvii, 47, 54
- Calvin, 79
- Cambridge, University of, xv, 22, 42–3,
46n40, 47–8, 106, 109, 112–13, 121–
3, 196
Christ's College, 110–12
course of studies at, 175–6
Emmanuel College, xviii, 106, 122–4
enthusiasm for Ramus, 133
Gonville and Caius College, 47
King's College, 122
Magdalene College, Pepysian Library, 3
Peterhouse, 112
Platonism, 106, 110, 115, 121–2, 124
purging of college libraries, 109
Queen's College, 122
St John's College, 108, 110–13, 122,
124
state of mathematics in, 134
Trinity College, 109, 122
- Candeler, Richard, 23, 72–3
- Canterbury Cathedral, choir screen, 79–80
- Cardano, Girolamo, 148
- Carr, Nicolas, 112
- Carter, John, antiquary, 86
- Cartwright, Thomas, sculptor, 84n32,
87n47
- Casa, Giovanni della, 90, 98
- Castiglione, Baldassare, *The Courtier*, 89–
90, 101, 108
- Cataneo
Girolamo, 148
Pietro, 201; *Prattiche delle due prime
matematiche*, 207
- Catena, Pietro, 153n46
- Cato, 120
- Caxton, William, *The Myrrour*, 93
- Chaderton, Laurence, 117, 121
- Challoner, Sir Thomas, 180
- Chamber, John, 143
- Charpentier, Jacques (Jacobus
Carpentarius), 114, 122
- Chelsea, Royal Hospital, Figure Court, 85
- Charles I, King, 45, 123
execution of, 82
statues of, for Royal Exchange, 81–4,
plates 8, 11
- Charles II, King, 64, 83, 85–6, 191
statue of, for Royal Hospital, Chelsea,
85
statues of, for Royal Exchange, 84–6,
plates 12–13; terracotta model
(Soane Museum), 86, plate 15b
- Charles V, Emperor, 13
- Charles, Richard, medical practitioner,
60n115
- Châtillon, Cardinal, 7n13
- Cheke, John, Regius Professor of Greek at
Cambridge, 112

- Chetwynd, Lord, 76
 Chrysostom, St John, 144
 Cibber, Caius Gabriel, sculptor, 86–7
 maquette of statue of King Edward III, 87, plate 16a
 maquette of statue of King Edward IV, 87, plate 16b
 Cicero, 90, 120, 144
 De natura deorum, 140
 Civil War, the, 88, 185
 Clavio, Cristoforo, 148
 Claymond, John, 111
 Clayton, Thomas, Gresham Professor of Music, 43n24
 Cleland, James, *The Institution...*, 95, 100–101
 Clement, John, 111
 Clerke, Bartholomew, Latin translation of Castiglione, 108
 Clough, Richard, factor to Sir Thomas, 22, 56
 Clutterbuck, Richard, 9
 Coeke, Pieter, 212
 Colet, John, 107n3
 Columbus, Christopher, 142
 Combes manor, Norfolk, 20
 Commandino, Federigo, 138, 153n46, 210–11
 publication of Bagedinus (1570), 168
 Commonwealth period, the, 45, 83
 Copernicus, xix, 125, 128n14, 130, 137, 141, 143–4, 151, 168n123, 172, 195
 debate over, 191
 Coro, Antonio, 121
 Council of State, the, 82
 Crakanthorpe, Richard, 115–16
 Croke family, members as Gresham Professors of Rhetoric, 45
 Crosby, Sir John, 7
 Cromwell, Oliver, 45, 81, 83, 190–91
 Crosse, Thomas, priest in Stepney, 60
 Crowne, William, Gresham Professor of Rhetoric, 43n24
 Cudworth, Ralph, 106, 122, 124
 Culing, Thomas, 10

 Dacres, Arthur, Gresham Professor of Geometry, 43n24
 Danti, Egnazio, 217–18
 Decembrio, Pier Candido, 107n3
 Dee, John, xviii, 46n39, 51, 112, 134, 150, 153n46, 168, 171, 178
 ‘absolute number’ of, 157
 Archimedean experiments of, 162–3, 170
 magical works of, 158
 mathematical entity of, 160
 mathematical practice of, 164
 Monas Hieroglyphica, 158–9, 159 fig. 2a&b, 162, 164
 Præface to Billingsley’s translation of Euclid, 154–6, 160, 164–5, 221
 views of geometry, 157–8
 Delamain, Richard, 183
 Delason, William, butcher, 18
 Delorme, Philibert, 200n3
 Demosthenes, 120
 Descartes, René, 98, 192–3, 195
 Dickens, Charles, *Dombey and Son*, 41
 Digges, Leonard and Thomas, 178
 Digby
 Everard, 106, 110, 113–14, 116, 121–2; eclectic Aristotelianism of, 114, 121; opposition to Ramus, 114–15, 121; *Theoria analytica*, 113; Platonist; metaphysics in, 113, 121–2
 Sir Kenelm, 45
 Diogenes Laertius, *Lives of the Philosophers*, 129
 Dirricke, surgeon to Sir Thomas, 53
 Dissolution, the, 48
 Dodson, James, 64n6, 69–70
 Duckett, Sir Lionel, 46n39

 Edward III, King, maquette of statue of, 87, plate 16a
 Edward IV, King, maquette of statue of, 87, plate 16b
 Edward V, King, statue of for Royal Exchange, 81–2
 Edward VI, King, xiv, 15, 51, 79, 109
 Eliot, John, 67
 Elizabeth, Queen, xiv, 4, 6, 21–2, 34, 42, 51, 53, 78–9, 91, 107, 134, 142
 control of image of, 81
 Insurance Act of (1601), 62, 73
 statue(s) of, on Ludgate, 80; for Royal Exchange, 81–2, 86, plate 7
 Elliott, John, factor to Sir Thomas, 16, 18
 Eltham, Palace of, 1
 Elyot, Thomas, *The Dictionary*, 94
 Erasmus, 79, 92, 109, 111–12
 translation of Epistle of St John, 90
 Estienne, Henri (Henricus Stephanus), 107
 Etaples, Lefevre d’, *Introductorium astronomicum*, 151
 Euclid, xix, 137, 139, 144, 168n123, 170, 208
 Elements of, 126, 134, 210, 213–14; translation by Billingsley, 154, 221
 works of, 128, 130, 132
 Eudemus, 136
 Evelyn, John, 79n6, 82, 189

- Evelyn, John, continued
Public Employment..., 100
 translation of Fréart de Chambray,
Parallèle..., 201
 Exeter Cathedral, west door, xvii, 80
- Fayre, William, 23
 Featley, Daniel, 115n36
 Fell, John, 115n35, 122
 Fernel, Jean, 51
 Ferneley
 Jane (Bacon), sister-in-law of Sir
 Thomas, 19, 56
 William, father of Anne Gresham, 18-
 19, 43n28
 Ficino, Marsilio, 118, 120
 Platonic Dialogues, 107, 109, 110n17,
 113-14, 115n35, 118
 Finés, Oronce, 135
 Fisher, Bishop John, 111-12
 Fisher, William, editor of Gellibrand's
 Epitome, 184
 FitzStephen, William, 3
 Flamsteed, John, Gresham Professor of
 Astronomy, 184-5
 Florence, San Lorenzo, Medici Chapel, 80
 Ford, Sir Richard, 9
 Forster, William, 183
 Foster, Samuel, Gresham Professor of
 Astronomy, 178-9, 180n18, 182, 195
 Fox, Bishop Richard, 110-11, 120
 Framyngham, William, 112
 François I, King of France, 205, 207
 Fraunce, Abraham, *The Arcadian
 Rhetoric*, 94
 Fréart de Chambray, Roland, *Parallèle...*,
 199-201, 207, 219
 Fulwood, William, 92-3, 95-6, 99
- Galileo, 166, 170, 191, 195-6
 natural philosophy of, 147
 Gassendi, Pierre, 192-3
 Gellibrand, Henry, Gresham Professor of
 Astronomy, xix-xx, 177-8, 180n18,
 181, 185, 194-5
 Epitome of Navigation, 182, 184
 Gresham lectures of, 182
 Geneva, University of, 120
 Genoa, 70
 George I, King, 76
 George I-IV, Kings, statues of for Royal
 Exchange, 86
 George of Trebizond, 118
 Gesner, Conrad von, 129
 Gibbons, Grinling, carver, 85-6
 Gibson, S., *The Only Rule to walke by...*,
 97, 101
- Gifford
 Dr John, 54
 Roger (=Jefford), physician, 53-4
 Giraldi, Giambattista, 98
 Gilbert, Sir Humphrey, 46n39
 Gilbert, William, 191-3, 195-6
 work on magnetism, 192-5
 Giorgi, Francesco, 205
 Goddard, Jonathan, Gresham Professor of
 Physic, 10, 190-91
 Goltzius, Hendrik, 52n77
 Gooderidge, John, Gresham Professor of
 Rhetoric, 43n24
 Gooderus, William, surgeon, 53
 Gossen, William (?=Gotherns), barber-
 surgeon, 53
 Graunt, John, FRS, xvii, 63, 64n6, 65-6, 70
 mortality table of, 65-6
 Gray, Hugo, Gresham Professor of
 Divinity, 122
 Greaves, John, Gresham Professor of
 Geometry, 122n58, 180
 Greenwich, Palace of, 2
 Gregory, James, 182
 Gresham family, 4, 18-20, 32
 Anne (née Ferneley), xiv, 4, 6-7, 17-22,
 34, 36, 43n28, 50, 56, 58-60, 77;
 entertainments of, 19, 59; death of,
 xv, xvii, 22, 57, 77
 Anne (Bacon), illegitimate daughter of
 Sir Thomas, xiv, 19-20, 34, 56, 58
 Cecily (Coill), cousin of Sir Thomas, 21
 Christiana (Thynne), sister of Sir
 Thomas, 19
 College, 4, 6-12, 37, 38-9, 44-5, 50, 52,
 74, 78, 106, 122, 146, 174, 178, 184-
 5, 195-6, 198; Act of Parliament
 (1768), 8, 11-12, 45n37, 188; call for
 reformation of, 176; connection with
 University of Cambridge, 124; course
 of studies at, 175-6; criticism of, 174,
 177, 184; demolition of, 8, 11-12,
 45n37, 187-8; educational provision
 of, 124; engraving, by George Vertue,
 6-7, plate 1; foundation of, xiii, xv,
 xvii, xx, 22-3, 56, 64, 77, 113, 115,
 146; gatehouse of, 7-8; lectures in, 4,
 39, 51, 175-7, 182, 184-6; observa-
 tory of, 7-8; ordinances of, 51;
 practical mathematics, reputation
 for, 195; professor of astronomy's
 laboratory, 10; professor of physic's
 laboratory, 8; professors of, xv-xvi,
 xviii, xxi, 4, 22, 43-4, 50, 74, 175,
 divinity, xviii, 122, geometry and
 astronomy, xviii-xix, 174, 178-80,
 182-6, law and theology, 174, physic,

Gresham family, continued

xvi-xvii, 38-9, 43-5, 47, 49-50, 61; stipulation about marriage of, xvii, xx, 42-5, 61; Reading Hall of, 7; relationship to Crown and Privy Council, 50; and Royal society, xix, 184, 186-8; telescope in courtyard of, 190; traditions and ethos of, 189
 Committee, Joint Grand, xv, xvii, xx, 6, 9-10, 41, 50, 78-9, 82, 84, 86, 190; dislike of the *avant-garde*, 81
 Edward, astrologer and mathematician, 46n39
 Elizabeth (née Markham), wife of Paul, 57n99
 Elizabeth (Nevill), niece of Sir Thomas, 19, 34, 36, 59
 Elizabeth, sister of Sir Thomas, 19, 47
 Frances, sister-in-law of Sir Thomas, 19
 'House of', 13, 15-17, 22; commercial operations of, 13-15, 17; Lombard Street offices, 22-3; Netherlands branch of, xvi, 13-14
 House, on Bishopsgate, xv-xvi, 4, 6-9, 11-12, 21-23, 44, 59, 63; almshouses of, xvi, 8, 22, 49; destruction of, 8; Great Hall of, 7; Green Court of (main quadrangle), 8, 10-11; Long Gallery of, 11; stables of, 8, 10-11
 Isabelle, step-mother of Sir Thomas 19, 34
 Sir John, brother of Sir Thomas, 19, 36
 Sir John, uncle of Sir Thomas, xiv, 13, 15-16, 19, 32, 34-6, 47-8, 56; bequests to hospitals and prisons, 49; Lord Mayor (1547), 19, 34, 49
 Noel, cousin of Sir Thomas, 21
 Paul, executor for Sir Richard, 57n99
 Repertories, 6, 8
 Sir Richard, father of Sir Thomas, xiv, 8, 13, 15-19, 21, 32, 34-6, 47-8, 55n90, 56, 57n99, 63; Lord Mayor (1537), xiv, 34, 36
 Richard, son of Sir Thomas, xv, 6, 18, 20, 34; death of (1563), xvi, xx, 21, 34, 36, 55, 58-9
 Thomas, uncle of Sir Thomas, 47
 Sir Thomas, 4, 6-8, 12, 13-21, 24, 32-4, 46, 54-5, 58, 60, 88; Act of Parliament (1581), 41, 59; activity in Cornwall, 16; adult education, as envisaged by, 175; almspeople of, 49, 56; as ambassador to Duchess of Parma, 21; apprenticeship of, 13, 36, attitude towards, 43; bequest(s) to Gresham College, 4, to hospitals and prisons, 49; broken leg of, 21, 53; death of, 57,

59; death of his mother, 34, 55; domestic arrangements of, xiv, 17-23; establishment of Exchange, xiv, xx, 22, 63, 77; failed to follow *cursus honorum*, 36, 49; funeral of, 37, 49; grasshopper symbol of, 6, 63; head of Netherlands branch, 14-15; hospitality of, 8, 20; host to Queen Elizabeth I, 6, 63; house in Basinghall Street, 17-18, 20; house in Lombard Street, 63, 66; household of, xvi, 8, 18-20, 56; illnesses of, xvii, 53; intentions of, for Gresham College, xv, 175; knighthood of (1559), xiv, 20, 35; life and background, 39; lifestyle of, 19-20, 49; London of, 150, 154; marriage of, 17, 34, 36, 43n28; mercantile connections of, 17, 22; as merchant adventurer, xvi, 17, 36; as merchant and royal servant, 40; as Mercer, 13-14, 17, 35-6, 42-3, 56; nominated for alderman, 34; perpetuation of name of, xv, 61; portrait(s) of, xiv, 43, 51; and 'practical' mathematics, 146, 198; production and reproduction in, 40, 55, 61; provision for his wife Anne, 22, 58, for mathematical sciences, 125; relations with Crown and Privy Council, 49; with medical attendants, 52-5; religious outlook of, 35-6, 42; reputation of, 41; as Royal Agent in the Netherlands, xiv, 15-18, 20-21, 34, 46-7; royalism of, 51-2; statues of, for Royal Exchange, 79, 84, plate 6; tomb of, xvi; will of (1575), xv, xx, 34, 36-7, 41, 53, 58-9; wishes for royal statues, 83

William, 13, 15

Gresham's Ghost, anonymous tract (1647), 174

Grey,

Lady Jane, 4

Lady Mary, 4, 55

Grouchy, Nicholas, 114

Guardian Royal Exchange Assurance Company, 7, 67, 70

Guazzo, Stefano, *Civile Conversation*, 90, 98

Guilds of London, *see* Livery companies

Gunter, Edmund, 126, 178-80, 182-3, 195

Guy, Thomas, founder of Guy's Hospital, 69

Gwinne, Matthew, Gresham Professor of Physic, 4, 44-5, 50-51

Gybbons, William, 73

- Hales, John, 115n36
 Halley, Edmund, 66
 Hampton Court Palace, 2, 123
 Handson, Ralph, 178
 Harrington, Lady Ann, 95
 Harriot, Thomas, xviii, 150, 153n46, 164-6, 170-71
 mathematical modelling of nature, 172
 representation of motion of, 166, 167
 figs 3-4, 169 fig. 5, 170
 treatment of ballistics of, xviii, 165, 171
 Hartlib, Samuel, 174, 191
 Harvey, Gabriel, xiv
 Heinsius, David, 115n35
 Henry II, King, 2
 statue of, on Royal Exchange, 82
 Henry VII, King, statue of on Royal Exchange, 81
 Henry VIII, King, 2, 15, 33
 1538 petition to, 48
 statue of, for Royal Exchange, 86;
 maquette for, 86, plate 15
 Henry, Prince of Wales, 180, 198
 Hermes Trismegistus, 112-13
 Hermetic writings, 107
 Heydon, Sir William, 178
 Heytesbury's 'mean degree theorem', 165-6
 Heywood, Thomas, playwright, 41n13, 52, 56
 Hill, Abraham, 191
 Hippocrates of Chios, 136
 Hobbes, Thomas, 176-7
 Briefe of the Arte of Rhetorick, 101-2
 Leviathan, 101
 Hoby, Thomas, translator of Castiglione, 89, 108
 Hogan, Edmond, 18, 23, 37
 Hogenberg, Frans, 3, 77-9, plates 5a-b
 Hollar, Wenceslaus, 82
 engraving of *Byrsa Londinensis*, 82, plate 9
 Holdsworth, Richard, Gresham Professor of Divinity, xviii, 122-4
 Praelectiones theologiae..., 123
 Hood, Thomas, 171, 177-8
 public lectures of, 177
 Hooke, Robert, Gresham Professor of Geometry, xviii, 6, 43n24, 124, 184, 186-7, 193
 Hooker, Richard, 115, 121
 Horton, Thomas, Gresham Professor of Divinity, 9, 45
 Hume, David, 91
 Humphrey, Duke of Gloucester, 107n3, 109
 Hurst, Anne, servant of Sir Thomas, 57
 Huygens, Christiaan, 191
 Iamblichus, 113, 118
 Inwood Hall, Norfolk, 8, 18, 20
 Jackson, Henry, 115n36
 Thomas, 106, 110, 113, 115, 119, 121-3;
 accommodation of Aristotle, 116-18, 121; Arminianism of, 115, 121;
 Eternal Truth of Scripture, 115-16;
 Primeval Estate of the First Man, 116; Ramism ignored by, 116;
 theological Platonism of, 115-16, 121; use of Aristotelian logic, 117
 James I, King, 53, 95
 statues of, on Aldersgate and Aldgate, 80
 'Jean de Montfert problem', the, 190
 Jewel, John, 115
 Jones, Inigo, xx, 215
 Justinian, Emperor, 107
 Kearne, Andreas, sculptor, 82
 Kepler, Joannes, 181, 192, 194-6
 Epitome of Copernican Astronomy, 190
 'Kepler's problem', 190
 Keys, Thomas, husband of Lady Mary Grey, 54-5
 Klingenberg, Poul, 65
 Knight, Richard, Gresham Professor of Music, 43n24
 Lambe, Sir John, 185n28
 Lambeth, Palace of, 3
 Lambin, Denis (Lambinus), 115n35
 Langham manor, Norfolk, 20
 Langton, Christopher, physician, 53-5
 Laud, Archbishop William, 121-2, 185
 Lawrence, Sir John, 9
 Leate, Nicholas, Master of the Ironmongers, 80
 Leiden, University of, 120
 Lemnius, *Touchstone of Complexions*, 91
 Leonard, Thomas, Gresham Professor of Law, 43n24
 Lechmere, Nicholas, Attorney General, 75-6
 Lever, Ralph, *The Arte of Reason*, 93
 Lhwyd, Edward, 187
 Lichfield Cathedral, west door, 80
 Linacre, Thomas, humanist physician, 48
 Lincoln Cathedral, west door, 80
 Livery companies, xvi, 29-31, 33, 85
 apprenticeship with, 26-7, 29-30, 32
 Barber-Surgeons, 50

Livery companies, continued

- Clothworkers, 30
 - Court of Assistants, 30
 - Drapers, 30
 - Fishmongers, 30
 - freemen householders of, 29
 - Goldsmiths, 30
 - Grocers, 30, 50, 86
 - Haberdashers, 30, 86
 - Ironmongers, 87
 - journeymen of, 29
 - liverymen of, 29-32
 - masters of, 30-1
 - Mercers' Company, xiv, xvi, 6-7, 9, 11-12, 13, 22, 30-31, 35, 43, 48, 78; Dr Assheton's Annuity Scheme, 7; as members of Gresham Committee, 41; Hall of, 75; Sir Thomas Gresham's officeholding, 35, 78
 - Merchant Taylors, 30
 - royal statues for Royal Exchange, 85
 - Salters, 30
 - Skinner's, 30, 86
 - yeomen of, 29, 32
- Livy, 144
- Lloyd, Edward, coffee-house of, xvii, 66-7
- Lloyd's insurance market, 11, 67-8
- London, City of, 1-3, 12, 14, 18, 37, 64, 80, 83-4, 195
- Admiralty Office, 9
 - Aldermen of, 10, 27, 30-32; Court of, xvi, 22, 27-8, 31-2, 34, 36-7
 - Aldersgate, 80
 - Aldgate, 80
 - Arundell House, 186
 - Bank of England, 77
 - Bethlem hospital, 48-9
 - bombing of, in World War II, 9
 - Braun and Hogenberg's map of, 2-3
 - Bridge, 2-3
 - Chamberlain of, 9
 - charities of, 33
 - citizenship of, 26
 - City Corporation of, xvi, 6, 9, 22, 41
 - City Recorder of, 9
 - civic culture of, 24
 - Churches of, Blackfriars, 2; Holy Trinity Priory, Aldgate, 2; Old St Paul's, 1-3; St Andrew's Undershaft, 9; St Benet Sherehog, 1n1; St Botolph's, Bishopsgate, 54; St Helen's, Bishopsgate, xvi, 9, 35, 55; St Lawrence Jewry, 55n90; St Mary le Bow, 70; St Nicholas Acons, 69; St Olave's, Hart Street, 9; St Pancras, 1n1; St Paul's Cathedral, 77; Whitefriars, 2

- College of Physicians of, xvii, 39, 45n34, 46-7, 49-50, 52-4; annals of, 50; foundation of (1518), 48; statutes of, 51
- Common Council of, 10, 28, 31-2
- Common Sergeant of, 10
- Company of Bricklayers, 78
- Company of Parish Clerks, 63-4, 66
- Copperplate Map of, 2
- Court of Admiralty, the, 71-2
- Crosby Hall, 7, 21
- customs house, reform of, 21
- Excise Office, 6, 11
- finance market of, 22
- Fraternity of St Nicholas, 63
- Globe Theatre, 3
- government of, 26-7, 30
- Great Fire of (1666), xvi-xvii, 2, 8, 11, 66, 69-70, 73-4, 78-9, 83, 86, 186, 197
- growth of, 25, 27
- Guildhall, 54, 78; Art Gallery, 81; Chapel façade, 82; Gate, 81; Library, 3
- Guilds of, *see* Livery companies
- Inns of Court, 42
- Lord Mayor of, 9, 10, 27-8, 31, 35, 71
- Ludgate, 80
- Mansion House, 77
- map of, by Ogilvie and Morgan (1676), 12
- marriage and remarriage in, 26
- medicine in, 39
- Members of Parliament for, 28
- migration into, 25-6, 32
- mortality rates in, 26
- Museum of, 2
- National Westminster Tower, 6
- panorama of, by A. van den Wyngaerde, 1, 3
- parishes of, 28; St George's Southwark, 179; St Helen's, Bishopsgate, xvi, 35; St Lawrence, 18; St Stephen's, Walbrook, 53
- plague in, 26, 47-8, 64-5
- population of, xvi, 24-6
- plan of, by John Rocque (1747), 5, 12, 62
- Public Records Office, 3
- Royal Exchange, xv, xvii, 4, 6-8, 10-11, 37, 51-2, 56, 62-3, 67-8, 74, 78; Cornhill façade of, 84; dedicated to God and the Crown, 80; destruction by fire (1838), 67; engraving of second Exchange, 84, plate 10, courtyard of, 86, plate 14; establishment of Gresham's, 22-3, 77; gallery of, 12; early insurance in, xvii, 62-3,

London, City of, continued

- 70, 73; merchants of, 72; Office of Assurances in, xvii, 10, 62, 68, 71-3; pawns of, 9-10, 77; rebuilding of, 10; rents of, 22, 74; sculptural decoration of, xvii, 51, 77, 84, thirty kings and queens in, xvii, 78-80, 82-4, 86; tenants of, 9, 51-2
 - rulers of, 33
 - St Katherine's Dock, 3
 - St Paul's School, 48
 - St Thomas Acre, hospital of, 48
 - sheriff of, 27-8, 31
 - Sir John Soane Museum, 86
 - society of, 24, 26, 31
 - Stock Exchange, 77
 - streets in, Basinghall Street, 18, 20;
 - Birchin Lane, 62-3, 70, Hain's coffee-house in, 67, John's coffee-house in, 67; Bishopsgate, 4, 6, 11, 21, Sir Paul Pindar's mansion in, 7; Broad Street, 4, 6, 8; Change Alley, 62, 68-9, Garraway's coffee-house in, 67, Jonathan's coffee-house in, 68, 70; Cheapside, 1-2, 20, 77; Cornhill, 7, 70, 77; Fleet Street, 70; King William Street, 70; Leadenhall Street, 68; Lombard Street, xvii, 6, 20, 22, 62-3, 66, 68, 70, 73, Edward Lloyd's coffee-house in, xvii, 66, 70, merchants of, 72; Lower Thames Street, 1n1; Ludgate Hill (Stationers' Court), 8n15; Nicholas Lane, 62, 69-70; Pope's Head Alley, 62-3; Poultry, 1n1; Queen Victoria Street, 1n1; Threadneedle Street, 70, 77
 - Survey of, by John Stow, 1, 3-4
 - Temple Bar, 24
 - at the time of Sir Thomas Gresham, 150
 - Tower of, 1-3
 - Victoria and Albert Museum, 7
 - wards of, 28; Bridewell, 25; Shoreditch, 2, 3; Southwark, 3, 24; Westminster, 24; Whitechapel, 24
 - woodcut map of, attrib. Ralph Agas, 2, 6
 - Yeldhall Gate, 18
- Louvain, 110
- Lucian, 109
- Lupset, Thomas, 111
- Machiavelli, Niccolò, 120
- Machin, Henry, 54
- Mair-Fugger consortium, the, 16
- Malynes, Gerard, 68, 71
- Markham
- John, servant of Sir Thomas, 57, 60

John, illegitimate son of Sir Thomas, 57-9

William, 57n99

Marlborough, Duke and Duchess of, 76

Martianus Capella, 118

Martin, Richard, 73

Martin's Bank, 6, 63

Masingham Priory, Norfolk, 20

Marr, John, 181

Mary Tudor, Queen, 2, 42

mathematics

- and astronomy, 151, 193-5

- application in magic, 163

- applied, xviii, 154

- and description of physical reality, 172

- demonstrations of, 152-3, 192-3

- emergence of, as a science, 148

- entities of, 151-3, 156, 163-4, 172-3

- idealism in, xviii, 150

- 'magical', 147, 164

- and natural philosophy, 153, 156, 193, 195

- and physics, 164

- practical application(s) of, xviii, 146,

- 150, 153-4, 160, 162, 164, 171, 173

- practitioners of, 149, 175, 180, 186

- procedures of, 148-50

- as a science; 'scientific', 147, 151

- superiority of, 153

- truths of, 152

Mayfield, Sussex, 21

Melanchthon, Philip, 109, 118

- introduction to Vöglin's *Elementale geometrica*, 131-2

Merchant Adventurers, 31-2, 85

Merston manor, Norfolk 20

Michelangelo, statues of the Medici by, 80-81

Middlesex, sheriff of, 27

Molyneux, William, 185

Moore, Dorothy, letters of, 91n12

Mor, Antonius, 51

Moray, Robert, 191

More, Henry, 106, 122

- Sir Thomas, 107n3, 111; circle of, 48

Mornay, Philippe du Plessis, *Six Excellent Treatises...*, 107n4

Mortality, Bills of, xvii, 63-6, 69

- causes of death in 1665 in, 64-5

Morris, Corbyn, 69

- Raphe (=Morrys), 53

Mosse, Henry, 10

Mounsell, Peter, Gresham Professor of Physic, 50

Mountayne, George (Montaigne),

- Gresham Professor of Divinity, 122

Mounteagle, Lord, 54

- Mountlow, Henry, Gresham Professor of Law, 4
- Münster, Sebastian, 135
- Murray, Mungo, Gresham Professor of Astronomy, 43n24, 45
- Napier, John, inventor of logarithms, 181
- Narford manor, Norfolk, 20
- Neile, Paul, 190–91
- Nelson, Captain Marmaduke, 178–9
- Netherlands, The, 47
- marts of, 13, 16–17
- Nevill, Sir Henry, 34, 37, 59
- Newton
- Isaac, 172, 182, 187
- Thomas, translator of Lemnius, 91
- Nicholls, Sutton, engraving of Royal Exchange courtyard, 86, plate 14
- Nicolson, William, Bishop of Carlisle, 187
- Nipho, Agostino, 119
- Northey, Sir Edward, Attorney General, 75
- Norwich, 49
- Nosocomium Academicum, 44
- Onslow, Lord, 76
- Orange, House of, 51
- Oresme, Nicolaus, 165
- d'Orleans, Charles, 1
- Osaldstone, William, Gresham Professor of Divinity, 122
- Osterley, Middlesex, xv, 7n13, 21
- Oughtred, William, 178, 183, 189
- Oxford, University of, xv, 42, 48, 120, 196
- Ashmolean Museum, 1
- Bodleian Library, 127, 130
- Brasenose College, 126
- Cardinal College (projected), 110–11
- Christ Church, 86, 111, 179
- Corpus Christi College, 108–12, 115, 118–19, 121
- course of studies at, 175–6
- humanist education in, 135–7
- mathematical/scientific education in, xix, 126–7, 134–5, 144–5
- Merton College, 126; Savile monument, 144–5
- Queen's College, 115
- Savilian Library, 127; Professorships, xviii–xix, 125, 127, 142, of astronomy, 125, 177, of geometry, 125–6
- scepticism about Ramus, 133
- Sheldonian Theatre, 214
- Padua, University of, 120
- Paesschen, Hendryck van, 7, 78
- Paget, Secretary, 13, 15
- Palladio, Andrea, 200–201, 215, 219
- Quattro libri di Architettura*, 219
- Pappus, 129, 132
- Paris, Matthew, 1
- University of, 111, 120
- Patrizzi, Francesco, *A morale methode of civile policie*, 98
- Paul of Venice, 119
- Peacham, Henry, *The Garden of Eloquence*, 94
- the younger, *The Compleat Gentleman*, 98, 100
- Peake, Robert, 198, 202
- Pearse, Peter (=Pierce), barber–surgeon, 60n114
- Pearson, Richard, 123
- Pearshall, Edmund, grocer, 60
- Pepys, Samuel, 79n6, 83
- house of, 9
- Perne, Andrew, 112
- Perkins, William, 117
- Percy, Henry, Earl of Northumberland, 172
- Peruzzi, Baldassare, 217–18
- Peter Martyr, St, 120
- Petre, Sir William, 54
- Pett, Phineas, 178, 180
- Pettie, George, translator of Guazzo, 90
- Petty, William, Gresham Professor of Music, xvii, 43n24, 44, 66, 174, 176–7, 191, 194
- Peurbach, Georg, 135
- Philip II, King of Spain, 2
- Philippes, Henry, 176
- Physicians in early modern England, 39–40
- sexual reputation of, 40
- tendency to marry late, 43
- Piccolomini, Alessandro, *De certitudine mathematicarum*, 151–3, 156, 171
- Pickering, Sir William, 47
- Pico della Mirandola, 113
- Pierce, Edward, sculptor, 87n47
- Piero della Francesca, 218–19
- Pindar, Sir Paul, mansion of, 7
- Plato, xviii, 107–12, 114–20, 123–4, 132–3, 137, 139, 157
- Alcibiades*, 120
- Apology*, 120
- as a 'holy philosopher', 118
- Gorgias*, 120
- Ion*, 120
- knowledge of, in Tudor England, 108
- Laws*, 108, 112, 120
- Menexenus*, 107
- Phaedrus*, 94, 112, 120
- philosophy of, 107

- Plato, continued
The Republic, 107n3, 111, 120
 on rhetoric, 89
Symposium, 108, 112
Theages, 120
Timaeus, 112, 120, 140
 Platonism, 106-7, 109-10, 112, 114, 120-21
 Cambridge, xviii, 106, 110, 115, 121-2, 124
 Elizabethan, 110
 Pliny, 108, 144
 Plotinus, 112-13, 118-19, 138
Enneads, 107, 111
 Plutarch, 109, 118
 Poliziano, Angelo, 118
 Pomponazzi, 120
 Pontano, Giovanni, *De rebus caelestibus*, 151
 Pope, Walter, Gresham Professor of Astronomy, 43n24, 184
 Porphyry, 113, 118
 Poussin, Nicolas, 201n8
 Primrose, James, 50
 Privy Council, the, 49-50, 71-3, 178
 Proclus, *Commentary on the First Book of Euclid*, 130, 132, 138, 151, 153, 168n123
 commentaries on Plato, 111, 113, 118
 Psellus, Michael, 118
 Pseudo-Dionysius, 113
 Ptolemy, xix, 138-9, 141, 143-4
Almagest of, 125, 127-30, 132, 135, 137
 Purchas, Samuel, 11
 Puttenham, George, 92
The Arte of English Poesie, 89, 94, 97, 100
 Pythagoras, theorem of, 213
- Quellin, Arnold, sculptor,
 maquette of statue of King Henry VIII, 86, plate 15a
 terracotta model of statue of King Charles II, 86, plate 15b
Quo Warranto affair, the, 85
- R., B., *Opinion Dieftied*, 95-6
 R., M., *A President for Young Pen-Men*, 97, 99
 Rainolds, John, 115, 118-21
An Excellent Oration..., 119
 attitude to Aristotle, 120
 critical of scolasticism, 119
 Ramist critique of Aristotle rejected, 119
 Ramism, 113
 Ramus, Peter, 88, 114, 134
Geometria, 133
Prooemium mathematicum, 129-34
 separation of rhetoric from logic, 93
 Raphael, 203, 217
 Ratcliffe, Ralph, 18
 Reade
 Francis, son of William Reade, junior, 59
 Gertruda, wife of William Reade, junior, 57n98, 59-60
 Mildred (Burghley), wife of Thomas, 59
 Richard, son of William and Anne, 18, 59
 Thomas, son of William and Gertruda, 57n98, 59-60
 William, mercer, xiv, 4, 17, 43n28, 55n90, 57
 William, junior, son of William and Anne, 18, 57n98, 58-9
 Recorde, Robert, 178
 Redmond, John, 111
 Reformation, the, 28, 33, 79
 Regiomontanus, astronomical works of, 128
De triangulis, 128
Epitome in Almagestum, 134-5
 Reinhold, Erasmus, 137
 Restoration, the, 82
 Reuchlin, 113
 Rheticus, 151
 Rhetoric, civic, 89-90, 97
 conversational, xviii, 88, 90-92, 99-100; prudence in, 100-102
 eloquence in, 94, 96
 ethos of probable and plausible in, 93, 96
 kinds of uncertainty in, 92
 deliberative, epideictic and judicial, 92-3
 negotiated, 95, 97
 of Peter Ramus, 93-4
 probable, 96-7, 99
 reasoning process of, 94
sermo and *negotio*, 97, 102
 teaching of, 88
 Richard I, King, statue of on Royal Exchange, 82
 Richard II, King, 79
 Richard III, King, statue of on Royal Exchange, 81
 Richmond, Palace of, 2
 Ringshall, Suffolk, 18, 20
 Rochester Cathedral, west door, 80
 Rocque, John, 5, 62
 Rome, 110
 Villa Farnesina, 217-18
 Rooke, Lawrence, Gresham Professor of Astronomy, 182, 190-91

- Rowe, Sir Thomas, 32
 Royal Exchange, the, *see* under London,
 Royal Exchange
 Royal Exchange Assurance Company, xvii,
 11, 62, 67-9, 75-6
 Royal Society, The, 6, 10-11, 38, 124, 184-
 5, 187-8, 191
 Fellows of, 190
 foundation of, xviii-xix, xxi, 182, 191
- Sacrobosco, *Spbaera and Therorica
 planetarum*, 141
 Sagredo, Francesco, 195
 Sansovino, Jacopo, 205
 Saracenus, Carolus, 212-13
 Savile, Henry, xviii, 125-45, 179-80, 183
 and astronomy, 139-42
 criticism of Ramus, 132, 138
 first lectures of (1570), xix, 126-8, 130,
 132, 138, 142, 144, 154n47; introduc-
 tion to Ptolemy in, 130-31
 and geometry, 139, 142
 history of mathematics of, xix, 136
 humanism and humanistic training of,
 136, 142, 145
 lectures on Euclid, 142
 mathematical education of, 130
 platonism of, 138
 and practical mathematics, 138-9, 144
 speech before the Queen (1592), 142
 Scamozzi, Vincenzo, 200
 L'idea dell'Architettura, 221n40
 Scarborough, Charles, 191
 Schegk, Jacob, 114
 Selden, John, 178
 Selme, Dr Daniel, 180
 Serlio, Sebastiano, 198-221
 on ancient architecture, 202-3
 discussion of modern architecture,
 203-7; of stage sets and design, 215,
 218-19
 on fortifications, 207
 'on Geometrie', xx, 208-15
 illustrations of, 201
 mathematical books of, 205, 207-8, 220
 on perspective, 215, 217-19
 work at Fontainebleau, 205
 writings on architecture, xx, 198-9,
 219-20
 Serres, Jean de (Johannes Serranus), 107,
 110n17
 Shakespeare, William, 3
 Sidney, Sir Philip, 53, 107n4
 Simplicius, Commentary on Aristotle's
 Physics, 136
 Sloane, Sir Hans, 187
 Smith, Sir George, 9
 John, 106, 124
 Sir Thomas, 54
 Soane, Sir John, 86
 Society of Antiquaries, the, 46n39
 Society of Apothecaries, the, 50
 South Sea Bubble speculation, the, xvii,
 62, 68-9, 76
 Sprat, Thomas, *History of the Royal
 Society*, 192
 Stanley, Thomas, 115n35, 122
 Stanyhurst, Richard, 119
 Stevin, Simon, *Problematum
 Geometricorum*, 153n46, 168
 Stiell, Wilhelm, 74n35
 Stiffkey, Norfolk, 34
 Stoicism, 114
 Stone, Nicholas, sculptor, 80-81
 Stow, John, 3-4
 Strada, Jacopo, 199
 Sturm, Johannes, 92-3
 Swineshead, Richard, 135
- T., D., *Essaies*, 95-6, 100
 Tacitus, 144
 Tartaglia, Niccolò, 148, 153n46, 165
 Tapp, John, 176
 Temple, William, 113, 133
 Themistius, 113
 Theon, 129
 Thomas à Becket, St, 2
 Thompson
 Anthony, 191
 Sir William, Solicitor General, 75
 Thynne, Sir John, 19
 Tuckney, Anthony, 117, 123
 Turner, Peter, Gresham Professor of
 Geometry, 43n24, 180n18
 Twisse, William, 115, 117
 Twyne, Brian, 115n36
 Tyson, Edward, Gresham Professor of
 Physic, 50n65
- Udall, Nicolas, 111
 Ulpian, Roman jurist, 65
 Uraniborg, 220
 Ussher, James, 181
- Vagabonds Act (1572), 25
 Valla, Giorgio, 118
 Lorenzo, eloquence of, 94
 Vandrebanck, Peter, engraving of Charles II
 statue, 85, plate 13
 Vaughan, William, *The Golden-grove*, 97
 Venice, 110, 206, 220
 S. Francesco della Vigna, 205
 Vertue, George, 6, 84n33
 drawing of Gresham statue, 79, plate 6

- Vernon, Admiral, capture of the *Porto-bello* (1740), 67
 Vespucci, Amerigo, 142
 Vicary, Thomas, surgeon, 48
 Victoria, Queen, statue of for Royal Exchange, 86
 Viète, François, *Canon mathematicus*, 133, 153n46
 Vignola, Giacomo Barozzi called da, 200–201, 217
 Viola Zanini, Giuseppe, 200n3
 ‘Vitruvius’, 174–5, 177
 Vitruvius, *De architectura*, 131, 202–3, 217, 219–20
 Vives, Juan Luis, 110–11, 117–18
 Vöglin, Ioannes, *Elementale geometrica*, 131
- Wallenstein, Albrecht, 220
 Wallingford, William, 135
 Wallis, John, 177
 Walpole, Robert, 67
 Walsingham Priory and manor, Norfolk, 20
 War of Jenkins’ Ear, the, 67
 Ward
 John, *Lives of the Professors...* (1740), 6, 188, 192
 Seth, Bishop of Salisbury, 177, 179
 Warner, Walter, 172
 Watson, John, 112
 Webb, John, 215
 Wells Cathedral, west door, xvii, 80
 Wells, John, 178
 Westacre Priory, Norfolk, 20
 Westminster Abbey, 1–3
 City of, plan by John Rocque, 5
 Hall, 79
 Palace of, 2
 Whichcote, Benjamin, 106, 124
 Whistler, Daniel, Gresham Professor of Geometry, 43n24, 179, 190
- Whitaker, William, 121
 White, Robert, engraving of second Royal Exchange, 84, plate 10
 Wilhelm, Landgrave of Hessen-Cassel, court of, 144
 Whittington, Richard, 37, 56
 Wilkins, John, 189–90
 William and Mary, King and Queen, statues of, 86
 Willis, Caleb, Gresham Professor of Rhetoric, 4
 Edward, *The Blind mans staffe...*, 98
 Wilson, Thomas, *Arte of Rhetoric*, 89, 93
 Wingate, Edmund, 182–3
 Winston, Thomas, Gresham Professor of Physic, 50–51
 Wolsey, Cardinal Thomas, 48, 110–1
 Woodward, John, Gresham Professor of Physic, 187–8
 Wootton, Anthony, Gresham Professor of Divinity, 4
 Worsopp, Rowland, Mercer, 10
 Wren
 Christopher, Dean, 189
 Sir Christopher, xix, 6, 78n3, 189–97, 201, 125; *Clavis mathematicae*, 189; *De Corpore Saturni*, 190; Gresham Professor of Astronomy, xx, 182, 189; ‘Greshamite’ history of, 192, 196; inaugural Gresham lecture, xix, 190–92; microscope and telescope, use of, xx, 193, 196
 Wright, Major, Notary Public, 10
 Wyngaerde, Anthonis van den, 1–2
 Wynne, Rowland, 9
- Xenocrates, *Axiochus*, 107
- York Minster, choir screen, 79–80
- Zarlino, Gioseffo, 205, 213–14